

Science Reporter

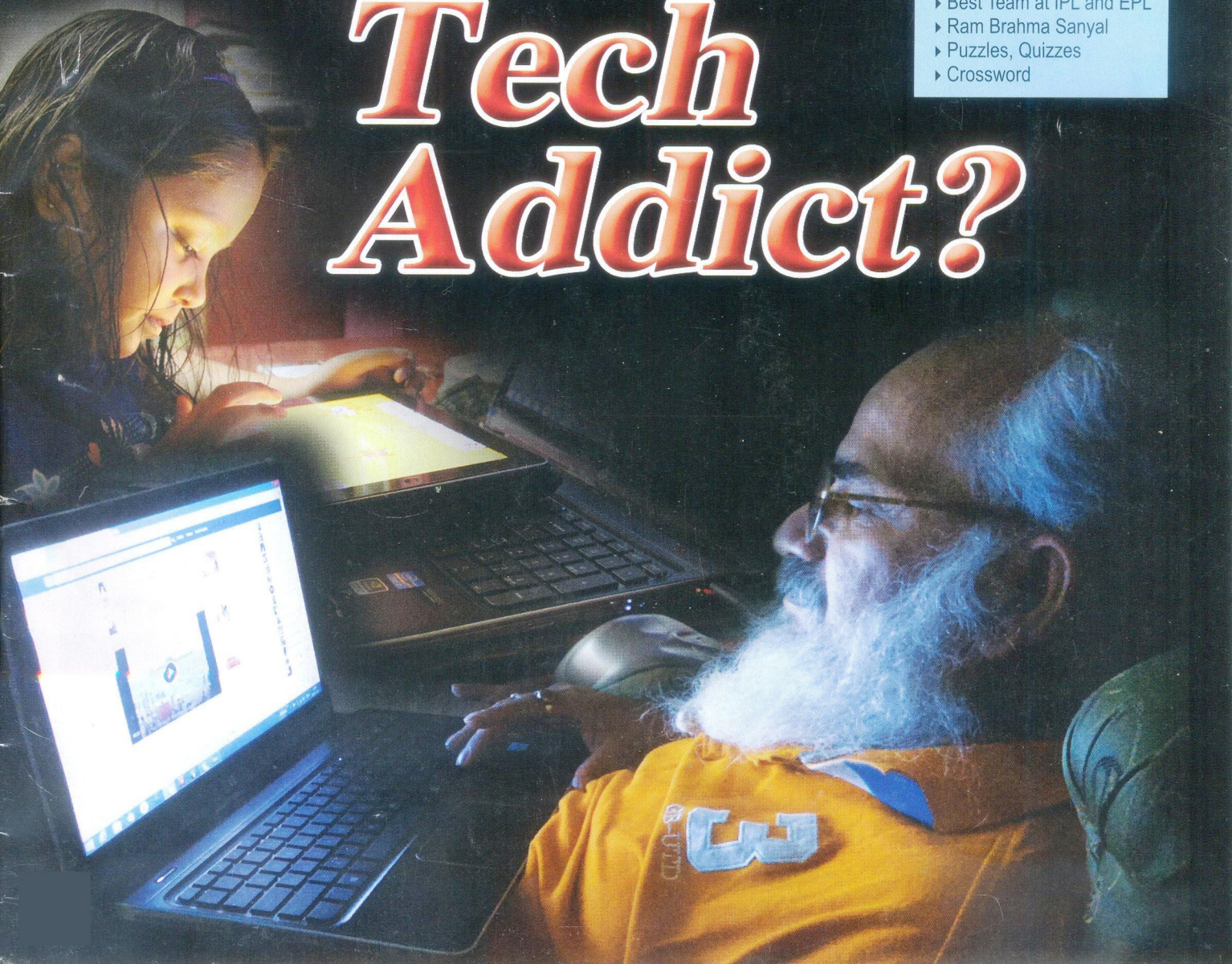


A CSIR
Publication

Are you a Tech Addict?

Also in the issue

- ▶ India's Research Ships
- ▶ Best Team at IPL and EPL
- ▶ Ram Brahma Sanyal
- ▶ Puzzles, Quizzes
- ▶ Crossword

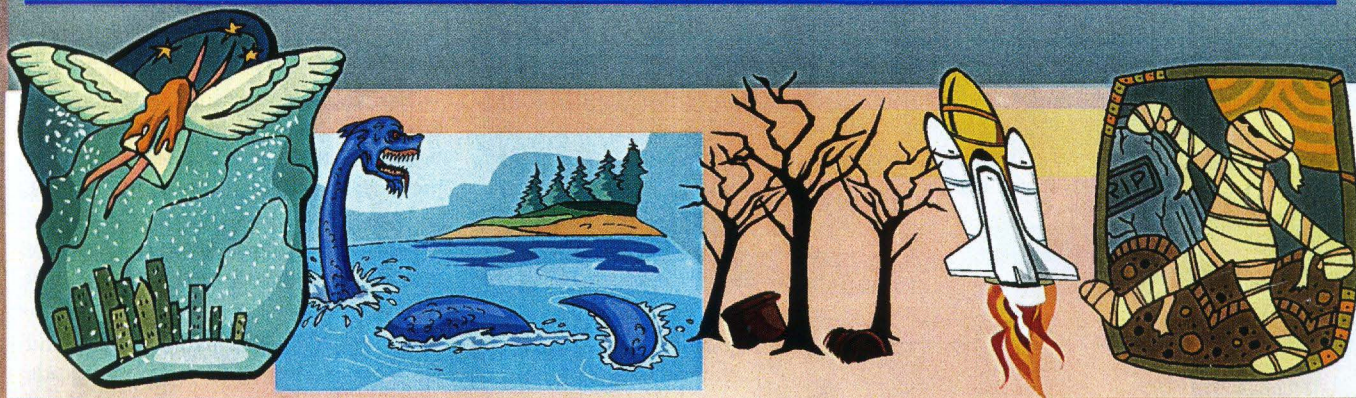


Results!

Science Reporter's

Results!

Science Fiction & Science Cartoon Competition 2013!



Here are the results of the

Science Fiction Competition!

Best Entry: Willie's Diving School by Suneel Sule

Second Best Entry: Skin to Bone by Beas Chattaraj

Third Best Entry: Choices We Make by Pranay Suman

Besides, the following fiction stories have been found worth publishing:

1. Science through the Ages by Picaro
2. The Village of the Vegetarians by M. Saleemuddin

And here are the results of the

Science Cartoon Competition!

Best Entry: Apple Falling into Black Hole by Devansh Rastogi

Second Best Entry: World Ozone Day by Rehan

Third Best Entry: Consequences of Global Warming by Meghna

Fourth Best Entry: A Human Mind Never Changes by Saurav Verma

Besides, entries by the following have been found worth publishing:

1. Probiotics by Richa
2. Ozone Layer by Ayushi Pragya
3. After the Development of Technology by Jithin Sai

CONGRATULATIONS WINNERS!



COVER STORY

ARE YOU A TECH ADDICT?

UJWALA KARMARKAR

It's time to get a hold on yourself and unplug before you succumb to tech addiction.

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ARTICLES

CHARLES DARWIN – THE GALAPAGOS AND EVOLUTION

K. VENKATARAMAN

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In the Galapagos Islands Darwin propounded his theory of natural selection in evolution.

YAR TSA GUMBA – NEGLECTED FUNGUS MARCHING TOWARDS EXTINCTION

DIPANJAN GHOSH AND SREEPARNA GHOSH

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Yar Tsa Gumba is a very costly and rarely occurring fungus on the brink of extinction from its natural abodes in India.

INDIA'S RESEARCH SHIPS – FEATURES AND FUTURE

D. RAJASEKHAR, D. NARENDRAKUMAR, P.S. DEEPAKANKAR, ANANTHAKRISHNA, K. RAMASUNDARAM, N. RAVI

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Indian research ships today are at par with their international counterparts.

THE BEST TEAM AT IPL 2014 AND EPL 2013-2014

GANGAN PRATHAP

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Review of the results of IPL-7 2014, using an improved understanding.

THE UNSUNG SCIENTIST—RAM BRAHMA SANYAL

SHAKUNT PANDEY

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SCIENTIFIC TERMINOLOGY IN COMMERCIAL ADVERTISEMENTS

MAHENDRA SINGH AND KULDEEP BAUDDH

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RIDDHI DATTA

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HASAN JAWAID KHAN

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FICTION

TRIPLE JEOPARDY

AADI SHARMA

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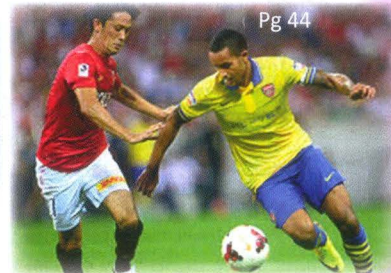
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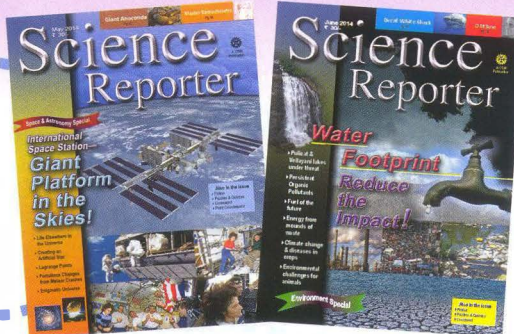


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Science Reporter



MASTER RAMCHANDRA

The article under the topic Indian Scientists on **Master Ramachandra** in the May 2014 issue of *Science Reporter* was wonderful and so informative, even for me, especially about the academic and scientific temper of this mathematician and educationist. I am his great grand-daughter.

An article in *The Times of India*, Sunday 18 June 1978 first drew my attention more keenly in the academic sense, to my great grand-father. The article – **An Unknown Mathematician**, by Brij Bhushan Sharma – gave details of the book *A Treatise on the Problems of Maxima and Minima* solved by Algebra by Ramachandra (published in England in 1850).

Then in the March 1993 issue of *Science Reporter*, through an article on Master Ramachandra, I came to know about some of his very special interests and involvements in education. I was fascinated. In April 1993 my husband specially traveled to Delhi, visited NISTADS, and personally interacted with the research scientists, Dr Irfan Habib and Dr Druv Raina, and collected some more information and material on Master Ramachandra. The NISTADS research team had put in tremendous efforts to collect the information and matter, not only from within the country, but also from abroad – England, USA, etc. For this I express my deep appreciation and thanks.

Master Ramachandra selflessly put in his best efforts to change the contradictory thinking of the people of those times, coloured with

religious dogmas. Through his articles and papers, printed in the vernacular, he tried to reach the masses, to educate and transform them to think rationally and scientifically and move away from superstition.

I sincerely wish that these remarkable efforts of his will be properly appreciated, and that he will be given a respectable place of recognition by the people of our country.

Thanks to NISCAIR for bringing out this article on Master Ramachandra.
Mrs Prita Dass, Ratanada, Jodhpur

ERRANT ASTEROIDS

It is satisfying to note that a strict watch is being kept on asteroids on a possible collision course with the earth (**Fortuitous**, May 2014). This vigil is maintained by the International Astronomical Union (IAU) if it comes closer than 7.5 million km.

In fact, hazardous asteroids have been assigned a risk-assessment scale – Torino-scale (somewhat like the Beaufort scale for wind speeds/wave heights and the Richter/Marcelli scale for measuring the intensity of earthquakes. In the Torino scale level 1 denotes “no cause for public concern” situation and 10 “a catastrophic event capable of ushering a global climatic change”.

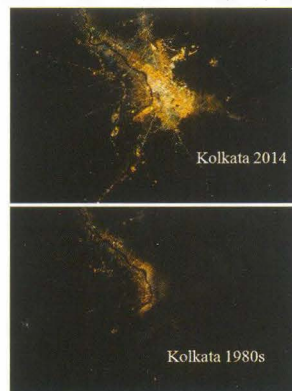
To divert dangerous asteroids heading for an earth impact scientists have come up with the idea of using “gravity-tractor” spacecraft, which will position itself alongside the hurtling intruder. It will exert a small gravitational force, which will eventually pull it away into a safer orbit. It has also been proposed to plant

powerful nuclear devices on such asteroids and blow them to smithereens hoping that the remaining debris raining on earth will meet a fiery end in the dense atmospheric layers.
Shashi, Indore

OVER ILLUMINATION

In the June edition of *Science Reporter*, specifically focused on the theme of environment; I too got stimulated and wanted to share some views of the dramatic changes on humans by a relatively new sort of pollution – Light Pollution.

Light pollution is something that limits our visual sense and causes distraction.



This in turn can also cause life-long errors. Temporary problems can include less perception of the eye to see dim objects, longer time taken by pupils to dilate in dark environment, etc. But in the longer run of life, it may cause stress, anxiety, mental disorder, distraction and possible loss of intelligence and concentration.

As an amateur astronomer, it also affects our vision for searching for deep-sky objects in suburbs or cities. Over-illumination has increased to such an extent that finding a suitable place for

some serious stargazing is very difficult.

The only medicine for this ‘disease’ is to avoid high-beam powerful lights; using mild lightings wherever and whenever required and preventing over-illumination by any means. If this is not taken care of ultimately our Earth won’t be a Planet but an “E-star”.

Gourav Kumar Tanti, Class-VIII,
St. Xavier’s School, Bardhaman

WATER SCARCITY

The latest issue with the cover story on water (June 2014) opened our eyes to the current situation and future impact of water scarcity. A water meter can control household water need. We need to develop technologies that can recycle water either in small or huge amounts. Waste water from domestic water filter should be reused in plants or for other domestic use. Finally, tree plantation remains the best cure to repair the environmental damage.

Nikunj Dave,
nikunjndave@gmail.com

HELP FOR ENGINEERING STUDENTS

The Basic Sciences Quiz in the May 2014 issue tickled my grey cells. Such puzzles and quizzes are very useful for Engineering students like me, especially the Electrical Engineering students. Thank you *Science Reporter*.

A. Sesha Sai Kashyap
Hyderabad

CORRIGENDUM

In the July 2014 issue, in the article “4126 and still counting...” the affiliation of Ms Dhriti Tandon was missed out: Ms Tandon is conducting a research project at CSIR-IGIB. She has won awards in school for excellence in academics. She can be contacted at tdandon.dhriti@gmail.com. The error is regretted.



Science Reporter

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HASAN JAWAID KHAN

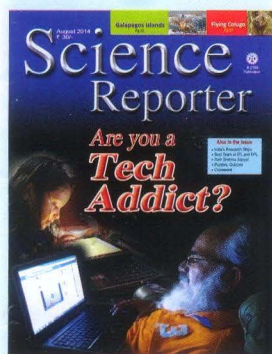
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COVER DESIGN
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ISRO's SOARING ROCKET, INDIA'S SOARING PRIDE

The launch of India's PSLV-C23 rocket was delayed by the prospect of satellite debris hurtling through space crashing into it. But eventually the Indian Space Research Organisation's workhorse Polar Satellite Launch Vehicle PSLV-C23 lifted off from the First Launch Pad at the Satish Dhawan Space Centre in Sriharikota at 9.52 am on 30 June 2014. It carried with it five satellites from four foreign countries. And between 17 and 19 minutes after liftoff, the PSLV placed all the five satellites into their intended orbits.



The probable space debris was from the 2011 collision of a US satellite and a Russian satellite at altitudes above 600 km. The two objects identified three days before the launch were 15 cm to 20 cm across. Travelling at great speeds, space debris measuring even a few inches across can damage spacecraft. However, with a delay of three minutes PSLV-C23 successfully avoided the debris without affecting the mission because it had a launch window period of 20 minutes. Since debris in space moves at a velocity of several kilometres per second, by slightly delaying the launch the objects can be avoided by thousands of kilometres.

With the successful insertion into orbit of all the five satellites riding on PSLV-C23, ISRO has notched up an impressive total of 40 foreign satellites from 19 countries that it has successfully launched so far, earning substantial sums of foreign exchange for the country. The countries include Algeria, Argentina, Austria, Belgium, Canada, Denmark, France, Germany, Indonesia, Israel, Italy, Japan, Korea, Luxembourg, Singapore, Switzerland, The Netherlands, Turkey and United Kingdom.

The primary payload of PSLV-C23 consisted of the 714 kg French Earth Observation Satellite SPOT-7. Built by Airbus Defence and Space, a leading European space technology company, SPOT-7 is identical to SPOT-6 launched earlier by PSLV-C21 in September 2012.

Along with the primary payload, PSLV-C23 also carried and placed in orbit the 14 kg AISAT, a nano satellite of Germany, for global sea traffic monitoring. It has been fitted with an array of antennas that will receive transponder signals during sea rescue operations. Two other satellites were NLS7.1 (CAN-X4) and NLS7.2 (CAN-X5) of Canada each weighing 15 kg whose primary objective is researching whether satellites can be designed to facilitate sub-metre tracking error accuracy. And finally, PSLV-C23 also placed into orbit the 7 kg VELOX-1 of Singapore, which is a technology demonstrator for the Singapore-based Nanyang Technological University's Undergraduate Satellite Program, designed to provide students with real-world aerospace experience.

The textbook precision launch of the five satellites on board PSLV-C23 has once again reinforced ISRO's commanding position as a leading space agency in the world, making India proud.

Hasan Jawaid Khan

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ROBOT STARTS WORK AS A TRAINEE SECURITY OFFICER

G4S, the security solutions group, have enrolled a new recruit this month when a robot from the University of Birmingham joined its workforce as a trainee security officer on a three week trial.

The robot, called Bob, is carrying out tasks such as patrolling the offices, and monitoring the environment, checking doors are closed and that desks are clear. This is the first time that an autonomous robot has been deployed in a working office environment to do a real job.

Bob is a very sophisticated robot because the research team has developed the software that enables him to process all the information he needs to map and navigate his environment. Using cameras and scanners he is able to create a map of his surrounding area, identifying desks,

chairs and other objects that he must negotiate when he is moving around, as well as detecting people's movement through activity recognition.

While Bob carries out his duties, he will also be gathering information about his surroundings and learning about how the environment changes over time – for example, where people go to, where objects appear, whether fire doors are open or closed. He will also know when to report to his docking station to charge up his batteries.

Bob is part of the £7.2 million STRANDS project where robots will learn how to act intelligently and independently in real-world environments, supporting security officers or care home assistants, while understanding 3D space and how this changes over time from milliseconds to months.

Dr. Nick Hawes, from the School of Computer Science at the University of Birmingham, who leads the STRANDS project, said: "We wanted to build an autonomous intelligent robot that can be put into a real world scenario like a place of work. Current robots aren't very good with their hands, or able to manipulate objects, however Bob is good at driving around and monitoring objects, so is perfect for a job in security as a night or day watchman where he can monitor what is going on in his immediate surroundings."

"The STRANDS project isn't going to produce a robot which can replace a human, but what it is going to do is support the security team by adding an additional patrolling resource. This will add huge value for our customers by frequently carrying out routine checks and highlighting abnormal situations which require response from our security teams," said David Ella, G4S Technology VP Product Marketing.

Simultaneously, a similar robot called Werner, will be deployed in a care home environment in Austria (Haus der Barmherzigkeit in Vienna). Werner will carry out similar duties to Bob, but he is also able to play simple games with residents in the home in order to foster a connection between him and the people he works around.



TWO INDIAN COMPANIES WIN ASHDEN AWARDS

Two Indian businesses, Infosys and Greenway Grameen, have been announced today winners of this year's International Ashden Awards, the world's leading green energy awards. The Awards were presented at a prestigious ceremony at the Royal Geographical Society in London.

Infosys is this year's winner of the prestigious Ashden Gold Award. Since 2008, the global IT giant has cut more than \$80 million off its electricity bills and

Now in their 14th year, the Ashden Awards celebrate pioneering businesses and organisations that are helping tackle climate change and transforming people's lives



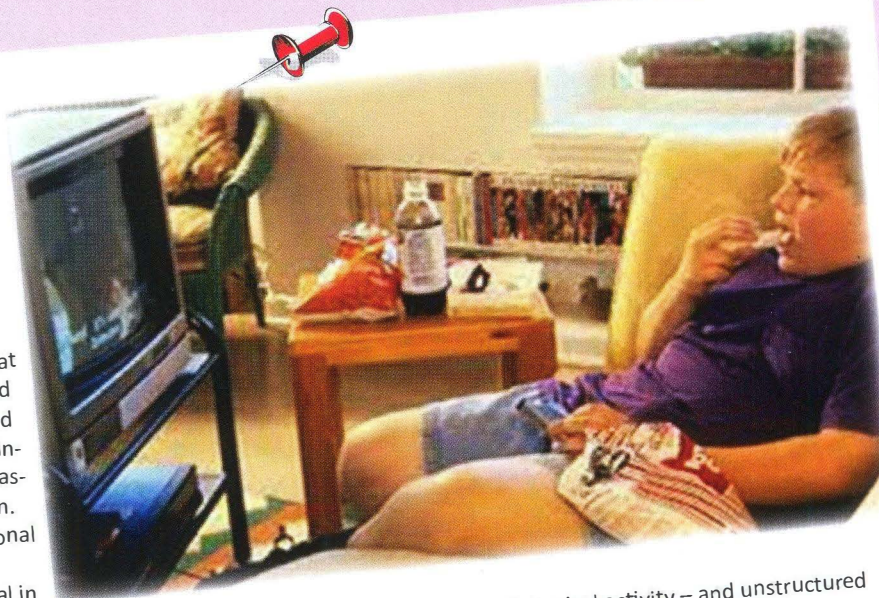
LITTLE EXERCISE AND TOO MUCH USE OF ELECTRONIC MEDIA RISKY FOR CHILDREN

The Physical Activity and Nutrition in Children Study, PANIC, carried out by the Institute of Biomedicine at the University of Eastern Finland shows that low levels of physical activity combined with heavy use of electronic media and sedentary behaviour are linked to an increased risk for type 2 diabetes and vascular diseases in 6–8 year-old children. The study was published in *International Journal of Behavioral Nutrition and Physical Activity*, an esteemed journal in the field of exercise and nutrition.

Carried out at the University of Eastern Finland, the study showed that low levels of physical activity – and unstructured physical activity in particular – are linked to increased risk factors for type 2 diabetes and vascular diseases in children. Furthermore, heavy use of electronic media, and especially watching too much TV and videos, was linked to higher levels of risk factors in children. The highest levels of risk factors were found in children with lowest levels of physical activity and highest levels of electronic media time.

Heavy use of electronic media, and especially watching too much TV and videos, increased the levels of risk factors not only in sedentary children, but also in children who are physically active. Moreover, irregular eating frequency and an unhealthy diet were linked to increased risk factors for type 2 diabetes and vascular diseases. These nutrition-related factors partially explain the link between heavy use of electronic media and the risk factors.

The PANIC Study has earlier shown that the cumulation of risk factors for type 2 diabetes and vascular diseases in people who are overweight begins already in childhood. This is a major concern because the cumulation of risk factors in childhood significantly increases the risk of type 2 diabetes, vascular diseases and premature death in adulthood. According to this recently published study, regular exercise and avoiding excessive use of electronic media constitute efficient means of preventing type 2 diabetes and vascular diseases.



Infosys is this year's winner of the prestigious Ashden Gold Award.

reduced electricity consumption per staff member by 44%. Its success lies in seizing every opportunity to reduce energy consumption in its existing buildings – from reducing the size of chiller plants for air conditioning, to painting roofs white so they reflect the heat. Cutting edge design of new buildings also helps keep offices

cooler and maximises natural light.

Greenway Grameen is a rapidly growing clean cookstoves business co-founded by entrepreneurs Neha Juneja and Ankit Matthur just two years after they completed their MBA in 2008. Greenway Grameen's mission is to provide an affordable, desirable

Since 2008, the global IT giant has cut more than \$80 million off its electricity bills and reduced electricity consumption

cookstove to improve quality of life for Indian women. In just three years the company has sold more than 120,000 stoves, thanks to clever marketing and a focus on designing a product that women actually want to use.

Now in their 14th year, the Ashden Awards celebrate pioneering businesses and organisations that are helping tackle climate change and transforming people's lives. A total of 14 Ashden Awards were presented this evening.

Greenway Grameen wins the first ever Ashden Clean Energy for Women and Girls Award. Infosys was awarded the first ever international Ashden Award for Sustainable Buildings.

Infosys, Hyderabad



ABEL PRIZE-2014

Order and chaos are two patently opposite phenomena and to explore connections between them is exciting. Yakov Grigorevich Sinai, an all time great Russian mathematician has taken up the challenge and has made fundamental contributions by developing the use of probability and measure theory in the study of dynamical systems for which he has been awarded the Abel Prize-2014.

Sinai's achievements include seminal works in ergodic theory. It studies the tendency of a system to explore all its available shares according to certain time statistics. He has also made important contributions to statistical mechanics, which explore the behavior of systems composed of a very large number of

particles, such as molecules of gas.

Known as the "Nobel Prize in Mathematics", the Abel Prize is being awarded annually by the Norwegian Academy of Science and Letters since 2003. The prize has so far been awarded to 14 mathematicians. The only Indian to receive the honor is S.R. Srinivasa Varadhan in 2007.

Y.G. Sinai, born on 21 September 1935 in Moscow, obtained his doctorate from the Moscow State University where he continued work as a Scientific Researcher at the Laboratory of Probabilistic and Statistical Methods (1960-1971) and then served as a Professor. He was also a Senior Researcher at the Landau Institute of Theoretical Physics, Russian Academy of Sciences and since 1993 he has been concurrently holding the post of a Professor in Mathematics of the Princeton University, USA.

He has achieved many ground breaking results in the theory of dynamical

"Yakov Sinai is one of the greatest mathematician of our time. ..."



"FOXTAIL ORCHID" UNDER THREAT

Orchid grows naturally in the forest ecosystem and plays a pivotal role in the plant biodiversity of our country. Out of over 1300 orchid species documented so far in India, about 800 species are native to eastern and north-east India.

Among the large number of tropical orchid species found to grow in India, *Rhynchostylis retusa*, which is commonly known as "Foxtail Orchid", predominantly grows in the forest areas of West Bengal, Jharkhand, Bihar and Orissa. This plant mainly grows as an epiphytic orchid on shelter plants like Mango, Teak and even Neem.

The orchid produces brilliant whitish violet-coloured long flowers on stalks that hang from the plant producing the shape of a fox's tail. It flowers during summer i.e. May-June and lasts for a long time. Due to the attractive shape and colour of the fully open flower it is largely used for bridal hair style during marriage ceremonies and also for interior decoration as cut flower.

Unfortunately, due to indiscriminate destruction of forest plants due to rapid urbanization, the biodiversity of natural orchid species is diminishing at a faster rate threatening the existence of foxtail orchid in India.

Contributed by Mr Soumendra Nath Das, Assistant Director of Agriculture, Department of Agriculture, Govt. of West Bengal, Email: soumendranathdas63@gmail.com



systems, in mathematical physics as well as in probability theory and is recognized as the major architect of most of the bridges connecting the areas of deterministic (dynamical) systems and probabilistic (stochastic) systems. In particular, he is acclaimed as the father of modern metric theory of dynamical systems, also referred to as the theory of stochasticity of dynamical systems. Many mathematical results with important bearings on both theoretical physics and mathematics are known after him. These include Kolmogorov-Sinai entropy, Sinai's billiards, Sinai's random walks, Sinai-Ruelle-Bowen measures, Pirogov-Sinai theory and Bleher-Sinai theory.

Yakov has published more than 250 original research papers in renowned journals and a number of books, some of which have been co-authored by his mathematician wife Elena B. Vul. He has also supervised more than 50 Ph.D. students.

The Abel Committee, confirmed the acclamation while recommending his

name for the current year's Abel Prize, with the remarks: "His works had and continue to have a broad and profound impact on mathematics and physics as well as on ever-fruitful interaction between these two fields."

His outstanding and immortal contributions to mathematics was profusely acknowledged in a special issue of the *Moscow Mathematical Journal* brought out to commemorate the 70th birth anniversary of Sinai in 2005. Its editorial quoted "Yakov Sinai is one of the greatest mathematician of our time. His permanent interest in mathematics and his exceptional scientific enthusiasm inspire several generations of scientists all over the world."

Contributed by Dr. Sunita Chand, Professor, Institute of Technical Education and Research (ITER), Siksha O Anusandhan University, Jagamara, Bhubaneswar (Odisha); Email: mami_chand@yahoo.co.in and Dr. Ramesh Chandra Parida, retired Professor, Odisha University of Agriculture and Technology, 124/2445, Khandagiri Vihar, Bhubaneswar-751030

NEW GECKO SPECIES DISCOVERED



A new species of gecko has been discovered in Maharashtra and has been named after eminent herpetologist Dr. Varad Giri. Dr. Giri has been associated with the Bombay Natural History Society and his contribution towards Indian herpetology is well known.

The genus *Cnemaspis* also known as dwarf gecko is described from the northern Western Ghats of Maharashtra. Geckos of the genus *Cnemaspis* have a rounded pupil which is unique to members of this genus unlike the cat-like eyes of other geckos. The new species, *Cnemaspis giri* inhabits dense evergreen forests along streams in the Kaas plateau of Satara district.

The gecko was described by a team of researchers from the National Centre for Biological Sciences, Bangalore and Centre for Ecological Sciences, Bangalore. It was first found during a survey of the Kaas plateau in June 2010 by Harshal Bhosale, Zeeshan Mirza and Rajesh Sanap. Only two species of the genus were known from southern Maharashtra and this was one of the two. To compare details of the new species Zeeshan Mirza and Rajesh Sanap visited the Natural History Museum, London to examine specimens of related geckos collected from India.

Mirza said that "the gecko is distinct from other Indian *Cnemaspis* and should be described as a new species".

Lateritic plateaus of the northern Western Ghats are unique and are like sky islands. Species that dwell on these plateaus are unique to this ecosystem and are endemic to these plateaus. The new species inhabits dense forests between plateaus that are much stable in terms of their climate which is extremely



harsh on the barren plateaus. The geckos take refuge under boulders and in tree hollows and are restricted to a narrow forest stretch.

Hemidactylus sataraisensis is another species that inhabits these lateritic plateaus and is found nowhere else in the world. Sanap adds that "the plateaus support a high degree of endemic fauna which still remains poorly documented".

The Kaas plateau is well known for its floral diversity that attracts hundreds of tourists to the plateau daily. The uncontrolled number of tourists is a major threat to the habitat with hotels and houses rapidly coming up in the vicinity of the Kaas plateau. Raising the status of

the Kaas plateau and surrounding plateaus to a wildlife sanctuary could perhaps help conserve this unique ecosystem.

The new discovery highlights the need for dedicated surveys across the northern Western Ghats to document the diversity of reptiles as many narrowly distributed species like *C. giri* would fall prey to the ever increasing anthropogenic pressure.

Contributed by Mr Mrityunjay Bose, Assistant Editor (Mumbai), Sakal Times. Address: 102, A-Wing, VK Tower, Evershine City, Vasai (East) Thane District-401208, Mumbai; Email: mritunjaybose@gmail.com



MENTHOL CIGARETTES ALSO HARMFUL

More and more young people are choosing menthol cigarette today with the belief that it is

safer than non-menthol cigarette. However, menthol cigarettes too are known to cause diseases like lung cancer, cardiovascular diseases (atherosclerosis, coronary heart disease, arrhythmias) and respiratory diseases (lung cancer, chronic bronchitis etc).

A recent study published in *Cancer Causes and Control* found that menthol users smoked an average of 43 cigarettes a week, close to double the 26 smoked by non-menthol users. The study also found that menthol smokers are more addictive than non-menthol smokers.

While smoking menthol cigarettes, the pleasant, cooling sensation causes the user to inhale more tobacco smoke with each drag. Menthol smokers thereby take in high concentration of nicotine than non-

menthol smokers. As a result, menthol cigarette smokers may have higher frequency of smoking related sicknesses and become more quickly addicted and also may smoke more cigarettes than those who smoke non-mentholated cigarettes.

Smoking poses a big risk especially among those who start smoking cigarettes regularly in their teenage years. It also harms people who are exposed to it passively. Menthol cigarettes have also been shown to inhibit nicotine metabolism, leading to increased systemic nicotine exposure.

Are You a Tech Addict?

UJWALA KARMAKAR

Picture Courtesy: Retik & Retika

"The difference between technology and slavery is that slaves are fully aware that they are not free."

— Nassim Nicholas Taleb

BEFORE you begin reading this article, just try out this simple test.

- Think back to the past one hour and try to figure out just how many times you checked your Smartphone or Tablet. Was it ten times or more?
- Try and remember the first thing you did, upon waking up this morning. After you turned off the alarm (on your phone), did you then squint at the screen, all bleary eyed and proceed to read (and answer!) the messages that had piled up during the night, while muttering an absent-minded "Good-Morning" to your partner?
- At the breakfast table (of course, you did not take the device into the shower!) did you do some pending work on

your phone? Perhaps check your phone anxiously, while munching your toast/paratha? Worse, do you even remember what you ate for breakfast?

- Across the table, was your partner engaged in similar activity? Even worse, were your offspring doing the same?
- On your way to work, did you pick up the phone to check the screen at every message alert and also check it when there was NO alert?

If the answer to most of the above is YES, then you are on the way to joining the ranks of technology over-users or technology dependent persons. In extreme cases such people are called tech addicts or screen addicts. Although, online gaming, gambling and pornography are the commonest forms of online-screen addiction, compulsive screen-checking is a milder form of this addiction.

What is Screen Addiction?

Tech or screen addiction is a broad term devised to define obsession with online video games, Smartphones, tablets, online gambling, online shopping, sexting, etc.

It is indisputable that information technology has changed our lives for the better in myriad ways. We are better connected, well informed, more aware and can easily do much, much more – all at the click of a button.

Footage of unrest in a foreign land can be conveyed to the world in a matter of minutes and you can plan your trip to your favourite destination sitting in the comfort of your homes. We can converse/skype with our Naani in the "gaon" with the same ease as shopping online for virtually anything from anywhere.

We can research any topic from manure for our garden to the components of rocket fuel. We can find our childhood friends on social media or look at Alpha Centauri with ease. Smartphones and tablets function as a personal diary, daily planner, calculator, email dispatcher, camera and music player; and are compact, easy-to-carry devices.

But, all this comes with a price – excessive use of this technology can easily become a dependence, and also, addictive.



When you are a tangled mess of cellphones, I-pads, laptops, emails, and the innumerable social media it's time to get a hold on yourself and unplug before you succumb to tech addiction.

The access to technology has become easy, its use simpler and cost affordable, there is an increase in the numbers of people who are becoming dependent on it to the point of obsession.

Picture Courtesy:
Retik & Retika

As with all other forms of addiction such as alcohol, drugs, and junk food, tech addiction is also characterised by a need to attain a "high" which is temporary. This is followed by a "low" when the addict seeks to reach the exciting "high" again by all means. Children, teenagers and young adults, who are termed "Digital Natives" – individuals who have been exposed to online entertainment from birth or a young age – are at a greater risk of being hooked.

Tech addicts even have an abbreviation for real life: IRL – in real life. Being IRL is something they begin to shun after a while.

Types of Screen Dependence

1. Repeated checking/activity of phone:

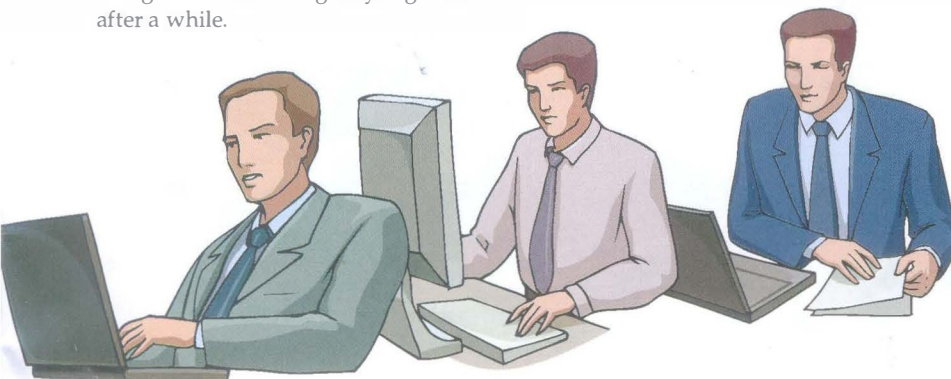
One glance at a youngster is enough to tell us about this obsession. At least half of them are checking or sending messages at a given time. It is not uncommon for a teen to message the person sitting right opposite! Nearly 125 messages are exchanged by 60% youngsters in a day; 80% teens admit to checking their phone every few seconds, in order to not miss a message.

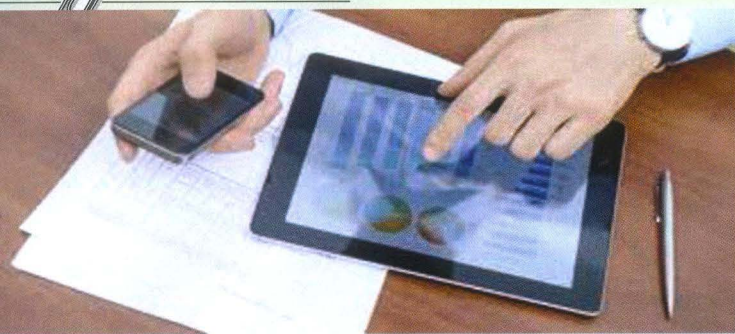
Changing profiles on social sites, updating status messages, uploading

selfies and forwarding YouTube videos and links is as necessary as breathing. Reportedly, many teens take their Smartphone to the bathroom, so as to not miss out on any text/call. Adults, particularly young ones, are afflicted with this as well.

2. Online gaming: The advanced software that makes online games challenging makes it more addictive as well. Realistic depictions, colourful imagery, complex challenges and never-ending levels combined with the zing of pitting yourself against opponents (in multiplayer games) can be fun. The illusion of participation (even as an "Avatar") is bizarrely surreal. (Military veterans who have seen action may compulsively play war-oriented games.)

Initially the person may play for an hour or two per day, and then will play four or five times as much, often squeezing in time at night, forgoing sleep or rest. Age, marital status or education are no bar for such addictions. *Unplugged* is a book written by a university professor Ryan van Cleave, about his journey in





and out of addiction. He was addicted to playing 'World of Warcraft' for days at a time, and almost lost his family and job in the process.

3. Online shopping: Seems innocuous, but for persons already suffering from "oniomania", or compulsive spending, the availability of online shopping sites seems like a 24/7 fix. They buy things that they do not need, want or use and pile them up, without ever taking them out of their boxes or removing the price tags. There are cases when bankruptcy has resulted due to this.

4. Sexting and online sex addiction: Sending provocative pictures over the phone to strangers is sexting and is often done over Snapchat, where the pictures disappear immediately after viewing. Viewing and downloading online pornography, adult fantasy role-play, frequenting online chat rooms and dating websites, often using different pseudonyms, are symptoms of hypersexuality, a dysfunctional type of behaviour. The anonymity of this activity lures many sexual predators as well. Some persons spend twenty to thirty hours per week or more on this.

5. Internet infidelity and virtual affairs (online romance): The idea of the 'perfect', compliant albeit unseen partner has lured many people who are dissatisfied or lonely persons, into affairs over the Internet. They may haunt social-media sites, online chat rooms and hook-up and dating websites in search of the perfect partner, often ignoring and breaking up from their real-life partner.

Tech or screen addiction is a broad term devised to define obsession with online video games, Smartphones, tablets, online gambling, etc.....

6. Online gambling: Craps, slots, blackjack, roulette, etc. are freely available online, giving compulsive gamblers the fix without having to ever leave their homes. As soon as a game is over, gamblers immediately start on a new one, many trying to recoup their losses and failing over and over again. It is a multi-billion dollar industry in the U.S.A. with little regulation.

7. Information overload: The need to compulsively know everything about a new subject can lead to compulsive data collection and compilation after researching on the Internet. Decreased work productivity can result due to this.

8. Obsession with social media: According to an ASSOCHAM study (Associated Chambers of Commerce and Industry in India), contrary to laws, over 70% children under the age of 13 are FB users, often with the knowledge

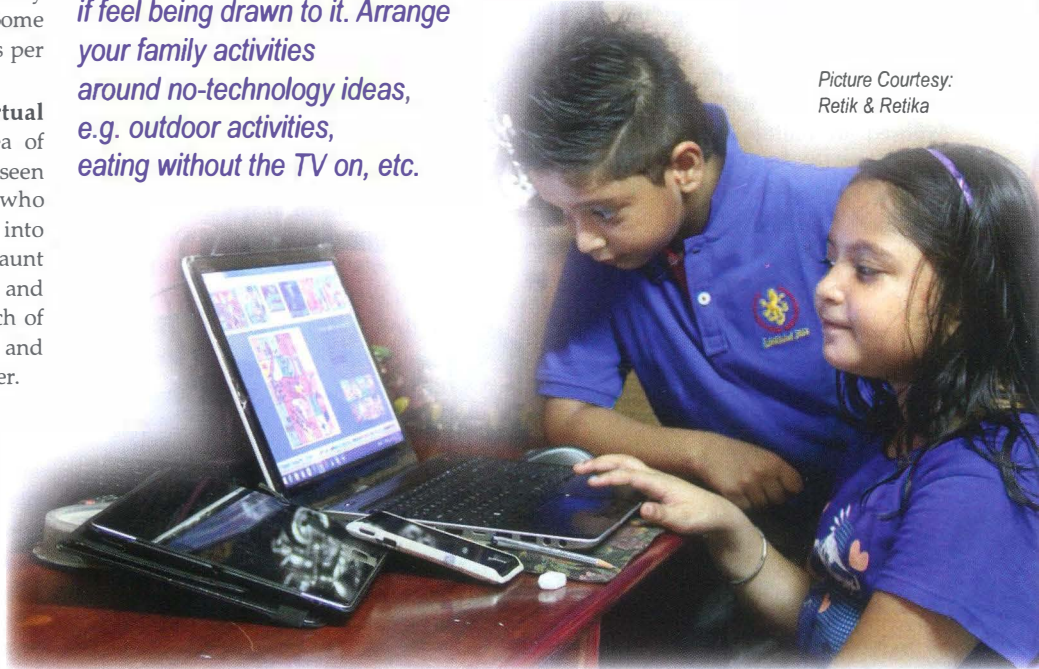
of their parents. This obsession results in repeated checking of profiles and activities of others, and also constant updating of one's own activities on these sites. Recently, an Australian woman slowly poisoned her child and posted updates of her 'illness' in order to generate sympathy, money and attention on Facebook.

Many individuals will have more than one of the above addictions. For example, a gaming addict may also have a social media obsession or sexting habit. Gambling, shopping and hypersexuality are behaviours which may be present inherently, and may increase due to use of the Internet.

After China, India has the largest population of mobile users. In our country, the ratio of personal mobile phones to persons is far more than the number of available toilets.

Do not hand over mobile phones to children at an early age.

Elders should keep off the social media sites and shopping sites, if feel being drawn to it. Arrange your family activities around no-technology ideas, e.g. outdoor activities, eating without the TV on, etc.



Picture Courtesy:
Retik & Retika

Picture Courtesy:
Retik & Retika



India has 554.8 million mobile users and 143.2 million unique Internet users. Around 94.7 million users access internet from their desktop/laptop, smart TV or mobile data connections such as GPRS/EDGE and 3G together. These numbers move up to 143.2 million if one adds the number of users who also access Internet through operators' portals such as Airtel Live and Reliance R World.

A New Generation survey conducted by the Cartoon Network channel in India in 2009, revealed that 95% kids live in homes with a mobile phone, while 73% of Indian kids are mobile phone users. Interestingly, of these, 70% fall under the age group of seven to 10 years while 76% are in the age group of 11 to 14 years.

In a study in school children for the *Asian Journal of Psychiatry*, conducted in Ahmedabad in 2013, it was found that over 11% of children using tech devices showed signs of tech abuse. If these statistics are conservatively applied to the numbers all over India, it amounts to many millions.

In 2013, the Indian Council for Medical Research also conducted a study on 2,750 subjects in the age group of 18-40 years in select urban communities across India showing an alarming rate of technology dependence.

How do we Know?

How do you find out whether someone close to you has fallen prey to this addiction? There are some tell-tale signs, look for them.

1. Altered eating and sleeping habits: Inattention to eating, lack of hunger and in severe cases, malnutrition, emaciation and collapse. Typically, a tech addict will stick to only those items which can be sipped or eaten with one hand, leaving the other free to continue playing (sometimes players may even use adult diapers to save time!). There have been almost ten cases from South Korea when persons playing online games for days at a stretch without a break, have suddenly collapsed and died. Also, lack of physical activity accompanied by binge-eating may result in severe obesity.

2. Nomophobia: A fear of not having a phone or no-mobile phone-phobia. Classically a sufferer will be upset by the thought of "no network", low battery situation, may carry two phones with different service providers, have an anxiety attack due to a misplaced phone. Desperation to find a missing phone will upset the schedule of the day.

According to the *Indian Journal of Community Medicine* (Dixit, Shukla; 2010), one in five Indian users is "nomophobic". In Western countries, this figure is reportedly three times more.

3. Mood swings: Loosely termed "Digital Attention Disorder", this is common in very young children. Irritability, anger, uncontrollable tantrums and frustration is seen, when they are prevented from "playing". In Western countries, children as young as four are being treated for this addiction.

In 2010, a 22-year-old man in South Korea murdered his mother who used to complain about his gaming habit and then, calmly returned to playing.

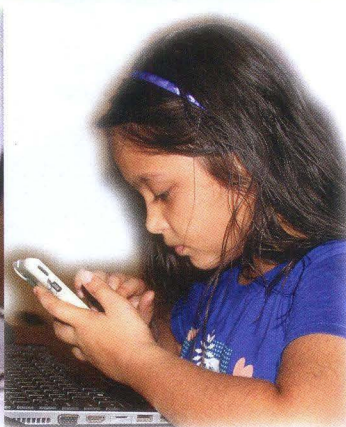
4. Decreased output at work/falling levels of academic performance: In 2005, the death of a student due to Internet addiction in an IIT prompted the institute to reduce the use of Internet in dormitories. Perhaps, the warning signs were missed in a milieu that encourages competition.

As parents may not be aware of their child's "online-time" whilst they are closeted in their room, often the first sign of tech or screen addiction is an unexplained fall in school performance as the number of hours spent indulging their addiction reduces the time spent in studying.

Workplaces are similarly hit. In the U.S.A., 71% of office workers abuse the Internet during work hours visiting social networking sites, shopping online, reading personal email, or visiting pornography, gaming, or gambling sites.

Picture Courtesy:
Retik & Retika





5. Social withdrawal: Every minute spent on the Internet takes away from any other 'normal' activity, particularly socialising with actual eye-contact, conversing, making friends, even living life.

It is debatable whether the tech addict turns to his screen because he is socially awkward to begin with and needs friends or his tech addiction makes him socially awkward. The two seem to perpetuate each other and the tech addict will be a person who cannot make conversation, has few 'real world' friends, and is isolated.

6. Neglecting responsibilities, consequences: In South Korea, a case was reported where a couple with a three-month-old baby was so engrossed in gaming that they neglected to feed the baby. The baby died due to starvation.

Tech addicts may completely neglect their duties at school or work and concoct elaborate lies in order to continue playing.

7. Depression and other mental disorders: Depression, low self-esteem, feeling suicidal is common among tech addicts. The initial euphoria fades away leaving a feeling of being sad and alone. Social media sites create illusions that

everyone seems to have plenty of friends and is perennially happy, which only increases this depression.

Children who have tech addiction have higher chance of having Asperger's syndrome, attention deficit disorder and learning disabilities.

8. Aggression and criminal behaviour: Nothing will seem more important than satisfying the addiction, often triggering criminal activities. Two Chinese boys argued over the ownership of a virtual sword. One murdered the other over what were really a few pixels! A teen in Vietnam murdered an 80-year-old woman for some money, in order to continue his online game.

"I fear the day technology will surpass our human interaction. The world will have a generation of idiots." – Albert Einstein.

Mechanism of Tech Addiction

Just as all casual drinkers do not become alcoholics, all tech users do not become addicts. The majority of the human population is able to use technology and integrate it into their lives without being hooked. We see it as fun, informative, entertainment, as part of our working lives or merely something that makes our lives easier. The emotional thrill of using these gadgets is kept under limits.

It has been suggested that tech addicts are perhaps neurochemically predisposed to being addicted. Happy or reward chemicals called dopamine are released in the brain, which becomes addictive and craving sets in when the use of technology ends. This is similar to a drug addicts' brain.

Howard Gardner and Katie Davis, two Harvard educators, just published *The App Generation: How Today's Youth Navigate Identity, Intimacy, and Imagination in a Digital World*. They feel that apps and dependence on them have taken away the creativity, imagination and reasoning skills of today's generation.

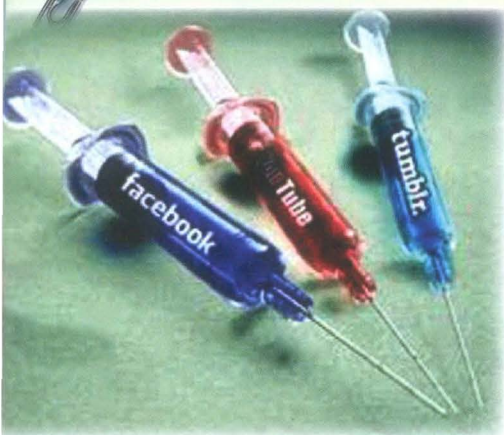
We accept the information given and remove the pathways in our brain which question this or think beyond it. As everything has an app, creativity takes a beating, they say. Music, literary work, drama, etc. is apparently less imaginative now than it was before, so is rational thinking.

Diagnosing Screen/Tech Addiction

Tech addiction is now included in *Diagnostic and Statistic Manual of Mental Disorders – DSM-V*. Based upon the DSM, Dr. Kimberly Young has developed the Internet Addiction Diagnostic Questionnaire:

- Do you feel preoccupied with the Internet (think about previous online activity or anticipate next online session)?
- Do you feel the need to use the Internet with increasing amounts of time in order to achieve satisfaction?
- Have you repeatedly made unsuccessful efforts to control, cut back, or stop Internet use?
- Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use?
- Do you stay online longer than originally intended?
- Have you jeopardized or risked the loss of significant relationship, job, educational or career opportunity because of the Internet?
- Have you lied to family members,





therapist, or others to conceal the extent of involvement with the Internet?

- Do you use the Internet as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)?

Answering "yes" to five or more questions is required to diagnose screen addiction, although some research suggests meeting three of the criteria is enough to diagnose.

Psychologists use cognitive behavioral therapy to overcome this addiction. It does help that tech addiction does not physically ravage the body like alcohol or drugs, making the transition to normal life slightly easier.

In some western countries, tech addicts often go cold turkey or enlist in boot camp style retreats to "unplug" or go on a "digital detox" and free themselves of their habits, the cost of these running to thousands of dollars.

Recently, the National Institute of Mental Health & Neuro Science (NIMHANS) opened the country's first tech-deaddiction clinic in Bangalore. But many more will be needed for a country as vast as ours.

According to a screening this year of 400 teenagers in Bangalore, from expensive private schools to government-run schools, NIMHANS found that they were spending inordinate time on mobile

phones, social networks and multi-player online games.

Preventing Tech Addiction

Now how do you prevent yourself or your loved ones from going down the tech addict pathway? There are some simple things you can take care of.

1. Unplug: Tech detoxification for a few hours does wonders. Resist the urge to check your phone. Better yet, switch off and head out for a walk. Disable notifications on your smartphone.

2. Set an example: Do not check your own phone during family time, at the dinner table, outing with friends, etc. This will give your children the right idea about priorities as well.

3. Activities and projects: Involve yourself in activities such as exercise, reading, cooking, etc. which do not solely rely on technology. Take up hobbies such as painting, pottery, music, etc.

4. Limit use of technology: Clock your own use and reduce it as far as possible. Keep off the social media sites and shopping sites, if you feel yourself being drawn to it. Arrange your family activities around no-technology ideas, e.g. outdoor activities, eating without the TV on, etc. Rearrange the furniture in your home so as to take away the focus from tech gadgets such as the TV or computer.

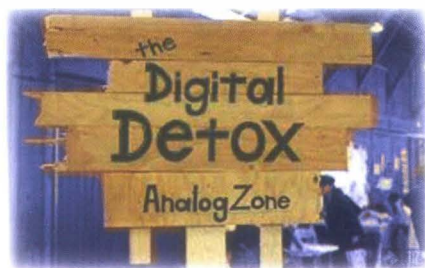
5. Monitor your children: Do not hand over mobile phones to children at an early age. Sudden decline in academic performances, mood changes, isolation, and changes in weight are warning signs. Teach your child to think before connecting and chatting or gaming.

We have a far easier life than the earlier generation, all thanks to technology. But as the access to technology

has become easy, its use simpler and cost affordable, there is an increase in the numbers of people who are becoming dependent on it to the point of obsession. The point of technology is to integrate it into our lives, not the reverse. The bad guy in this tale is not technology, but the user of this technology who is abusing it.

Technology is a double edged sword; it can simplify and complicate our day-to-day lives. But letting ourselves get addicted would be akin to committing hara-kiri with it.

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Picture Courtesy:
Retik & Retika

Scientific Terminology in

OPC grade

MAHENDRA SINGH AND KULDEEP BAUDDH

MEA

Megapixel

SPF

Glyceride

Ultrafiltration

Nitrates

COMMERCIAL advertisements have today increasingly started using scientific terminologies to impart authenticity to their products. Some advertisements use scientific facts to make consumers aware of the ingredients or strong points of their products. For instance, there are several categories of cement products on the basis of OPC grade (compressive strength of cement is shown in Ordinary Portland Cement grade like 43, 44, 54 etc.). This information may be relevant for application of such products for different purposes.

However, there are several other advertisements that use scientific terms without any relevance and often end up misleading consumers. Sometimes the scientific terms used have no relevance to the product. For instance, a famous mobile brand named on luminous, which does not have any relationship with the term being used. Kinetic is another well-known brand based on scientific terminology.

Advertisers are frequently applying terms from the physical sciences to market their products, like digital (in advertisements of lighting equipment, gadgets, electronic appliances like ovens, washing machines, air-conditioners, etc.) or luminous (for lighting products), where most customers are kept in the dark regarding the exact output of luminosity in different places and situations. Another term used is RPM being used in advertisements of automobile engines, electrical fans, farm equipment, etc. where most advertisers are not talking about the impact of RPM on the output of the products or machine efficiency.

Terminologies from the field of electrical engineering have become common in advertisements of electrical and electronic products. The term wattage helps consumers pick up lighting equipment based on their requirement and also know about energy saving in halogen-based lighting equipment. Degree Celsius (°C) is used in

advertisements for air conditioners (ACs), room heater, and engine lubricants. However, it is more important to discuss the exact difference being made by ACs in balancing temperature and humidity rather than talking only about temperature.

Mileage refers to fuel efficiency in automobile industry. Since the average buyer of a motor vehicle looks for mileage, in India the entire competition in the market is today based on efficiency of fuel consumption being offered by companies. Before the 80s in India, fuel efficiency was secondary, but with the entry of Japanese automobile companies, the word "mileage" gained currency. Speed, acceleration, torque, strength, elasticity, aerodynamics, combustion in engine, gross weight, and net weight are again some common scientific terminologies from physics communicated to consumers via commercial advertisements.

Terminologies from the world of chemical science are also being increasingly used in commercial advertisements. For instance, advertisements of skin care and toilet material talk of glyceride and boric acid as antiseptic. Boric acid is a mild antiseptic as well as a mild acid that inhibits the growth of microorganisms on the external surfaces of the body but at the same time it may cause irritation and have poisonous characteristics if taken internally in large amounts, which advertisers are not communicating.

Many cosmetic creams contain petroleum jelly as the main constituent. Petroleum jelly is a by-product of

petroleum refineries. It is insoluble in water and does not get oxidized when exposed to air. It also has healing and moisturizing properties. However, it restricts the pores of the skin from letting toxins and moisture out, which also needs to be communicated. This would make consumers aware about its side effects on prolonged usage.

Advertisers are also creating awareness about thickening and darkening of skin by the effects of UV radiation and suggest application of sunscreens with sun protection factor (SPF) as remedies. Sunscreens act by absorbing, scattering or reflecting UV. The sun protection factor (SPF) gives an indication of the effectiveness of the sunscreens.

Detergent cake and powder ads also use scientific terms like hard water, soft water, lime, and aqua shine formula. Menthol is often mentioned in pain relievers – menthol (methyl salicylate) suddenly cools the skin and distracts from the feeling of ache or pain.

Water purification gadgets also display terms like reverse osmosis, ultraviolet, ultrafiltration, etc. Ultraviolet filtration is a disinfection process and a non-chemical method for destroying micro-organisms by changing their genetic material, and making them unable to reproduce. Many scientists often wonder that if mutation occurs in the microbes at the time of treatment, these may become more hazardous.

Advertisements for toothpaste and oral care products use chemical terms like salt, calcium, rinsing, and fluorides.

The use of scientific information has made it easier for advertisers to make customers aware about the efficiency of the products being offered.

Commercial Advertisements

Luminous Kinetic RPM CFC free Fluorides Reverse Osmosis
Cholesterol Mileage PU
Boric Acid Petroleum jelly Degree Celsius
Ammonia Fly Ash
UV radiation Menthol

The amount of fluoride contained in fluoride toothpaste should be indicated on the toothpaste tube. Many scientists have investigated that the use of fluoride toothpaste containing 1,000-1,500 ppm fluoride could lead to enamel fluorosis of the front permanent incisors. It is a condition which can vary from minor white spots to slightly yellow or brown discoloration of the enamel due to excessive intake of fluoride.

Hair care and hair colour ads also try to entice customers by talking about ammonia and ammonia-free hair colors, gel, and aqua. Earlier ammonia was largely used in hair colour due to its ability to open up hair cuticles and increase the penetration of hair colour molecules but due to increasing environmental and health concerns ammonia has been replaced by MEA (monoethanolamine), which provides similar functions. But again being a chemical its side-effects cannot be ignored.

The construction and allied industry also depends on terms from chemical science to promote its products – for instance, rust and iron oxide formation in steel bars, harmfulness of sulphur and phosphorus in steel rods and bars. Similarly cement ads are included with information on fly-ash, slag based blending, sulphate resisting Portland cement, rapid hardening of cements. Fly ash is one of the residues generated in combustion. It is a waste material produced by thermal power plants. Due to its chemical composition, disposing off the fly-ash in the soil can be hazardous. These days, many cement-manufacturing companies are using it as an ingredient which has proven better results in strength and water-absorbing capacity. This fact is often being advertised.

Fashion and footwear commercials give out chemical information like PU

(Polyurethane), Nylon, polyesters and acrylic in synthetic comfort wears, mattresses and cushions. Polyurethanes are used in the manufacturing of flexible, high-resilience foam seating, rigid foam insulation panels, microcellular foam seals and gaskets, and durable elastomeric wheels and tires. Isocyanate is a key ingredient of PU and is considered to cause asthma, lung damage, and other respiratory and breathing problems, and skin and eye irritations. Similarly nylon again has been reported to cause a number of skin-related problems which are never mentioned by companies. A number of synthetic clothes have different toxic chemicals which are being absorbed while in use and cause many diseases. But advertisers only talk about their advantages like wrinkle free, shrinkage-free and water-repellant garments.

Biological information is often conveyed through advertisements to create awareness and promote products. Food and beverage products are giving information about preservatives, nutritional values, vitamin and mineral content. Food preservatives are used for extending the shelf-life of foods but some preservatives like nitrates and nitrites are known to be linked to an increased risk of cancer, brain tumor, diabetes and diarrhea.

Edible oil advertisements are giving out information about fat content, heart safety, cholesterol management, etc. Ads of health foods give information about the role of dietary fibers and enzymes in digestion, vitamin and nutritional values in their products. Health supplements often talk about minerals, vitamins, calcium and their role in growth of body and mind. Similarly biscuits and bakery ads convey informations on nutritional value of glucose and minerals, lactose, pepsin etc.

Environmental awareness is one area through which companies are gaining popularity in the sense of corporate social responsibility. Information on biodegradable packaging, lead-free petrol, recycling of lead acid batteries, plantations of trees, rain water harvesting, CFC-free appliances, and efficient lighting appliances is being fed to consumers to make intelligent choices.

In recent years, terminologies from the field of computer science and information technology, such as megapixel, gigabytes, high definition display, and aspect ratio have become handy to market computers, memory drives, disk drives, digital cameras, and mobile phones.

Commercial advertising helps in offering and making choices of products. The use of scientific information has made it easier for advertisers to make customers aware about the efficiency of the products being offered. However, consumers also need to be aware and not be attracted or misled by the mere use of scientific terms in advertisements.

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Two Day Seminar at NIAS, Bangalore

When Science Meets the Public: Bridging the Gap

A politician once famously exhorted his followers not to vote for the ruling party since the dam it had built had squeezed out all energy from the water. Yet another chief minister is known to have consulted an astrologer when a supercyclone was heading towards the shores. The astrologer predicted that the cyclone would break into two and so there was nothing to worry about. Hundreds died as the cyclone hit the state.

Last year, despite serious misgivings about unplanned development in the hills and innumerable reports to that effect, the establishment took note only when a disaster struck Uttarkashi and thousands lost their lives. And, of course, even today we keep reading and hearing about people flocking to pay obeisance to fake sadhus and babas who have a penchant for irrational, unscientific and totally ridiculous utterances.

Despite mastering the most advanced mobile phones easily the public still remains confused whether transgenic technology is good or bad, whether nuclear reactors will solve our energy issues or create new radiation hazards, and whether development at all cost is advisable. Policy makers and lawmakers too continue to move ahead with unscientific development projects. Where does the problem lie?

Perhaps we are not doing enough in science communication, says Prof. V.S. Ramamurthy, Director, National Institute of Advanced Studies, Bangalore. He was delivering his opening remarks at a two-day seminar on *When Science Meets the Public: Bridging the Gap*, which tried to delve into the chasm between science and scientists and the lay public. Prof. Ramamurthy went on to say that taking the public into confidence on complex scientific issues was essential today.

The seminar was organised by the National Institute of Advanced Studies, Bangalore during 20-21 June 2014, catalysed by eminent journalist Pallava Bagla who is also a Visiting Professor at NIAS, Bangalore.

Mechanisms need to be worked out to foster greater networking and interaction between the scientific and the journalistic communities.

Prof. V.S. Ramamurthy (left) with Dr. S. Ramadorai and Dr. K. Kasturirangan (extreme right)



Prof. V.S. Ramamurthy, Director, NIAS, Bangalore with Dr. S. Ramadorai, Chairman, NIAS, Bangalore

Engaging the civil society has become increasingly essential also because the public has today become sceptical of government communication, said Dr K. Kasturirangan, former member, Planning Commission, in his inaugural address. This is clearly demonstrated by the public outcry over stem cells, GM crops and nuclear reactors, he said. He cited the example of the Chandrayaan-1 project as a case of extremely successful engagement with the public that generated strong "trust plus" in contrast to "deficit plus". There was a need, he said, for independent communication agencies to engage with public bodies.

The two-day seminar brought together science journalists and communicators, natural and social scientists, science administrators, policy makers, researchers and even parliamentarians on one platform.





Former Environment Minister Mr Jairam Ramesh with Dr. Baldev Raj, Mr Pallava bagla, Dr. Shiv Vishwanathan and Mr Gauhar Raza

The seminar was timely especially in view of the growing cases of resistance against national projects. While more transparency in scientific projects is required to allay fears of the civil society, at the same time resistance from segments of the society needs to be understood in the proper perspective. Arguing that many knowledge bases are being bulldozed, sociologist Shiv Viswanathan said that the scientific community needs a "hearing aid to understand the dialects of resistance". We should stop seeing people as just those who obstruct science and understand the pluralisms our society has. He said different groups have different truths, which needed to be understood.

Prabir Purkayastha, editor of *Newsclick*, also said that technologies are always for the benefit of people, but people are not homogenous. So, while some may stand to gain, others may lose. He cited the example of GM crops in this regard. While farmers will benefit from increased yields, consumers will have to consume the transgenic crop without health hazards, if any, being taken care of, hence the resistance. Bt cotton did not have any such issues. In the same manner, people in the US simply do not accept climate change because they do not want to change their lifestyles. Prabir argued that it is important to address the belief systems of people to be able to communicate science well.

But do we have any idea of the belief systems and the scientific bent of mind of the citizens of such a large country like India with mindboggling diversities of language, culture, topography, social strata, educational status and so on? Gauhar Raza from CSIR-NISCAIR pointed out that no national level study had been carried out so far in India to gauge the level of scientific awareness of the Indian populace. Science communication and scientific awareness programmes will have to be designed based on such an understanding, he said.

Once people develop an understanding of scientific issues it is easier to take them along. This was beautifully exemplified in a presentation by Magsaysay Award winner Rajendra Singh. Singh said development work of the urban psyche involves displacement of water, soil, forests, people, etc. But local development work involves development of local resources. He recounted how he managed to create awareness in the villagers of Gopalpura in Alwar district of Rajasthan about their problems and the need to look for local solutions rather than depend on government aid. This led to building of embankments to store water, consequently raising the water level in dry wells and rejuvenating rivers. An excellent example of a communication initiative that yielded sustainable results.

Another issue that was raised by several speakers related to the lack of accessibility of information from scientific organisations

and agencies. This is a problem often faced by journalists. The issue was raised by T.V. Jayan from *The Telegraph*, a Kolkata-based newspaper and T.V. Padma from *SciDev.net*, an online science news portal. Why this should be the case is somehow difficult to understand. On the contrary, scientific organisations, departments and agencies need to be professionally and ethically mandated to engage the public with the scientific projects they work on and the scientific products they roll out.

However, scientists and scientist-administrators had a different take on the issue. Srikumar Banerjee, former Chairman of the Atomic Energy Commission and Deepak Pental, former VC of the University of Delhi and a leading voice in favour of GM crops, while accepting that information needs to be made available to journalists, talked of the lack of trust among the scientific community about journalists turning out factually correct reports due to their penchant for sensationalising events. In fact, Banerjee even talked of a difference between "journalistic knowledge" and "scientific knowledge".

Perhaps, therefore, apart from bridging the gap with the public what is also required is bridging the gap between scientists and journalists. Mechanisms need to be worked out to foster greater networking and interaction between the scientific and the journalistic communities.

Throughout the two days of the seminar, however, there seemed to be no doubt that more efforts were required to engage the public with science at different forums. Of course, India can boast of a number of science communication initiatives, both at the national level as well as the regional level. However, these efforts are widely scattered. There has hardly been any effort to bring together such programmes and projects to amplify their effectiveness on a large scale.

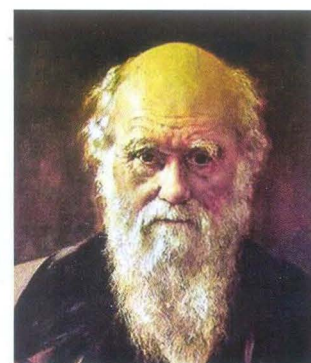
Perhaps there is a need to chalk out a national science communication policy or strategy. Such a national policy or strategy could bring together all scientific departments, organisations and universities to forge effective science communication initiatives. It could also assess the level of scientific awareness of different segments of the society and devise science communication programmes accordingly.

It needs to be realised that today public receptivity to science is high. However, unimaginative and piecemeal efforts at communication will only transform this receptivity into serious misgivings about science. At the same time, effective communication programmes hold the potential to increase receptivity among the public for critical and national scientific projects and endeavours.

Hasan Jawaid Khan

Charles Darwin, Galapagos and Evolution

K. VENKATARAMAN



When Darwin arrived in the Galapagos Islands almost a hundred and eighty years ago, little did he realise that he would stumble upon life forms that would ultimately lead him to propound his theory of natural selection in evolution.

THE Galapagos Islands are an archipelago of volcanic islands distributed around the equator in the Pacific Ocean, about 600 miles West Coast of South America. The islands have given birth to and seen the death of many species of flora and fauna.

The islands became famous around the world after the survey ship HMS Beagle, arrived in Galapagos in 1835 with the naturalist Charles Darwin. These islands were declared a National Park

in 1959. It is a UNESCO World Heritage site. Galapagos in Spanish means tortoise. There are giant tortoises on these islands.

The islands consist of a vast number of endemic and endangered flora and fauna. Fur seal, Rice rat, Sea lion like mammals, land and marine Iguanas, Tortoise, Lava lizard, Flat-tailed lizard-like reptiles, Blue-footed boobies, Albatross, Penguin-like birds, Hammerhead shark, Bat fish, Gala damsel-like fishes, Scorpion spider and Carpenter bee-like arthropods are

worth mentioning. These islands are considered a "Living Museum".

The islands are thought to have formed about 19 million years ago by the creation of volcanoes due to the melting of Earth's crust from below by the mantle of the plume. The islands are named in Spanish and English languages.

Baltra is considered as the land of the Iguana. Bartolome is one of the younger islands where the smallest species of Penguin are found. Fernandina

The Galapagos Islands are unique in the incredible variety of creatures that live there. The interactions between each other are very evident in the biological interrelationships

The endemic fauna of Galapagos are of the greatest conservation interest because their future depends entirely on their continued existence in the islands.

Tortoise long necked

Tortoise short necked



From left: Ground Finch, Cactus Finch; Vegetarian Finch; Insectivorous Finch

is the youngest island where hundreds of marine Iguanas gather on the black lava rocks, besides flightless Cormorants. In Floreana, Galapagos petrel, the sea-bird, is found which spends most of its life away from land. Green turtles and flamingos are also seen.

Genovesa is nick-named as the bird island or bird watchers' paradise. The only nocturnal species of gull in the world, the swallow-tailed gulls and frigate birds, are present on this island. Isabela is the largest island where marine Iguana, Sally lightfoot-crabs, penguins and cormorants are present. Marchena is the home for the Lava lizard, an endemic species, besides hawks and sea-lions.

North Seymour is the home for blue-footed boobies and swallow-tailed gulls. Pinta is the land of Pinta tortoise. Rabida is a bird watchers' delight. Nine of the fifteen species of finches have been reported in this island. South Plaza Island is where the largest sea-lion colonies are seen. San Cristobal has the largest fresh water lake. Giant tortoises, blue and red-footed boobies are common in this island.

In Santa Cruz are located the Charles Darwin Research Station and the

headquarters of the Galapagos National Park. Santa Fe is a forest of Opuntia cactus. Land-Iguana, sea-gulls and tropic birds are common here. Santiago is the home for large varieties of invertebrate animals. Darwin finches and fur-seal are common here. Vampire finch is the famous resident of the island.

However, the Galapagos archipelago is characterized by a paucity of animal life. Amphibians are completely absent. In the animal kingdom there is only one marine lizard, the marine Iguana, and it is living here only. There are about 80 species of birds. The bulk of land birds are finches. The mammals are represented by only seven species of rodents and two species of bats. There are about 700 species of insects.

These islands are also of interest because of the high percentage of endemic forms. Besides, the terrestrial vertebrates show a striking lack of fear of land predators and man. Though the islands are situated on the equator, species of Antarctic origin such as Penguins and Fur seals also live on these islands.

The most celebrated visitor to the Galapagos Islands was undoubtedly the

young Charles Darwin in 1835 on board HMS Beagle. The ship was homeward bound after spending three years charting the coast of South America from Rio Plata to Chiloe in Southern Chile. In his travels ashore on the Pampas of Argentina and in Cordilleras of the Andes, Darwin collected animals and fossils and studied the geology.

In September 1835, the Beagle arrived in the Galapagos Islands. Darwin landed on the San Cristobal Island. He was not much impressed by the island's appearance at first sight. On 24th September, when the Beagle moved on to Floreana, he met the giant tortoise. The next day he visited Isabela and Pinta where Darwin first saw the land Iguana. On 8th October, he visited Santiago where he saw many tortoises and collected varieties of birds. HMS Beagle had spent just five weeks in Galapagos waters, but Darwin's presence on board ensured that Galapagos would occupy a special place in the history of science.

Darwin's innate qualities of enquiring critically with an open mind into every one of his observations had given rise to doubts in his mind about



Wood pecker
Finch



Penguin (left)

Flightless Cormorant (below)



North Seymour is the home for blue-footed boobies and swallow-tailed gulls. Pinta is the land of Pinta tortoise. Rabida is a bird watchers' delight.

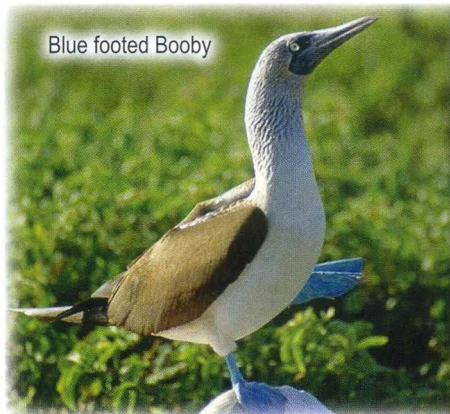
the correctness of the view of creation held at that time by most scientists as well as the church. In Galapagos, Darwin found a remarkable population of plants, birds and reptiles that had developed in isolation from the mainland, but often differed on almost identical islands and whose characteristics he could explain by a gradual transformation of the various species.

Back home, Darwin handed over his fossil collections to his mentor John Stevens Henslow at Cambridge. Richard Owen also helped Darwin in identifying the fossils and most of them represented species not yet familiar to experts.

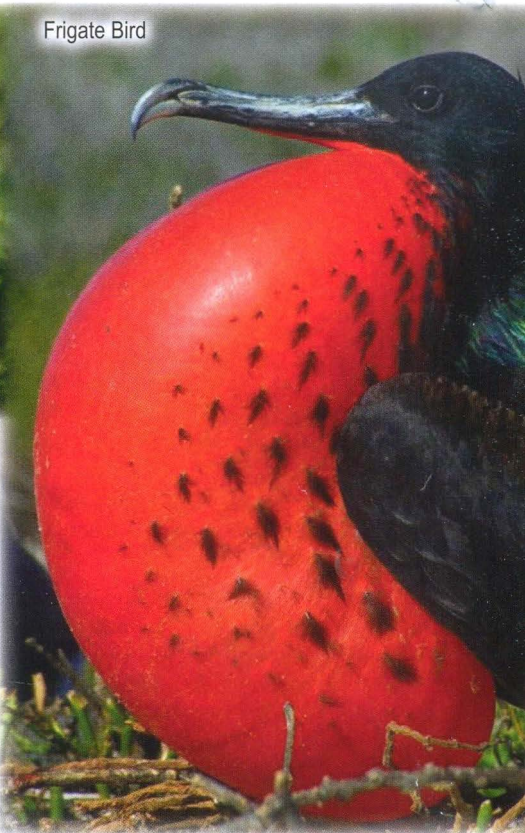
During his second voyage to Galapagos, a group of fifteen species of passerine birds were collected by Darwin. These birds are found only in Galapagos Islands. These birds are named by Percy Lowe as Darwin finches. The largest is the vegetarian finch and the smallest are warbler finches. They show differences in the size and shape of their beaks which are adapted to different food sources. They are grouped into Ground finches, Cactus ground finches, Vegetarian tree finches, Insectivorous finches, Wood pecker finches and Warbler finches.

Darwin finches of Galapagos Islands more resemble the birds of the neighbouring continent, North America, than the birds of distant islands or continents. Hence, it is believed that North American finches were ancestors of Darwin finches. The ancestral birds migrated to Galapagos Islands in the past.

The Galapagos archipelago was an oceanic island; it was free from enemies with a variety of ecological niches. All these islands are separated from one another by the ocean water. Hence the ancestral population on each island was sufficiently isolated from other such populations.



Blue footed Booby



Frigate Bird

The ancestors of finches reaching there made themselves comfortable in the different islands. The islands differ from each other in many features of the environment and in the food plants available. As a result each island population developed its own adaptation in its particular island condition. These adaptations included genetical, morphological, and behavioural changes. As these adaptations were different from one island to the other, the different populations did not interbreed when they came into contact with each other. In the absence of interbreeding, each population would be considered as a separate species. Another remarkable feature of Darwin finches is the existence of a number of subspecies.

These finches laid the seed in the minds of Darwin for the germination of the Natural Selection theory in evolution. These finches show adaptive radiation and form clear evidences for evolution. They also show that isolation brings about evolution and the origin of species.

During his second voyage, Darwin observed the differences in tortoises of San Cristobal and Santiago islands. In Floreana he did not observe any tortoise as the tortoise subspecies was nearly extinct. On islands with humid highlands, the tortoises are larger with domed shells and short necks; on islands with dry lowlands, the tortoises are smaller with saddle-back shells and long necks. Darwin's views on the mutability of species were rested in his notebooks: "Animals on separate islands ought to become different if kept long enough apart with slightly differing circumstances".

During Darwin's time it was believed that God created species independently and had chosen to place them, almost arbitrarily, in their particular



Marine Iguana

locales – kangaroos in Australia, giraffes and Zebras in Africa, Rheas, Sloths and Armadillos in South America – extinct and living forms clustered closely in space and time. The clustering in time and space thus hinted that each group had descended with modifications from common ancestors.

The data Darwin collected in Galapagos was important in shaking faith in the orthodox view persuading him that evolution was a reality. Alluding to the Galapagos species differing island by island, he said that species gradually become modified by transmutation. How did this transmutation occur?

In 1838, in England, the Industrial Revolution had made rich the owners of production, not the workers. In increasingly crowded cities, ordinary



Fur seal



Land Iguana

Galapagos archipelago is characterized by a paucity of animal life. Amphibians are completely absent. In the animal kingdom there is only one marine lizard, the marine Iguana, and it is living here only.

people struggled for their daily existence. It was under such circumstances that Darwin, coming back from his voyage on the Beagle and trying to understand the forces that drove the origin of new species, read the works of Thomas Malthus, a social economist.

Malthus believed that unless people expressed restraint in the number of children they had, the inevitable shortfall of food in the face of spiralling population growth would doom mankind to a ceaseless struggle for existence. Out of that battle some would survive and many would not, as famine, disease and war put a ceiling on the growth in population.

This idea galvanized Darwin's thinking about the struggle for survival in the wild where restraint is unknown. Darwin could apply these ideas to

populations of all species and came up with the idea of "survival of the fittest". Malthus's idea seemed to support all observations Darwin had done on Galapagos finches and their beak adaptation. Only individual species that had favorable adaptations would survive long enough to pass those traits to their offspring. This is the cornerstone of "natural selection".

These clues from Galapagos Islands led Darwin to conclude that Earth's living diversity had arisen by an organic process of descent with modification – evolution as it is now known and that natural selection is the mechanism.

In 1858, Darwin received a draft of an essay from a British Naturalist named Alfred Wallace. He was collecting biological specimens in Southeast Asia for

sale to museums and private collectors. Darwin was surprised to read that Wallace had come upon the same explanation for evolution. Darwin gave due credit to Wallace for the natural selection theory during the debates over its validity at a meeting of the British Association for the Advancement of Science in Oxford.

In 1859, Darwin finally published his theory of evolution for the public and scientists in a 490-page book entitled *On the Origin of Species*. It was this book that convinced most scientists and other educated people in the late 19th century that life forms do change through time.

The endemic fauna of Galapagos are of the greatest conservation interest because their future depends entirely on their continued existence in the islands. Galapagos fauna like giant tortoise, land Iguana, penguins, flightless cormorant and many others are considered jewels of the archipelago.

The Galapagos National Park and the Charles Darwin Foundation provide an up-to-date assessment of the status of each species for use by conservationists. Habitat loss, invasive species, predators and vectors, global weather, ocean pollution and human activities are considered the principal reasons for extinction of the island species. While the GNP does most of the field work, the CDF provides research information and scientific advice.

The Galapagos National Park collects eggs of tortoises and entrusts them at the Charles Darwin Research Station. After the eggs hatch, the young ones are kept until they are big enough to resist attacks by predators and then they are repatriated to their home island like Espanola. They also aim to remove the alien species which threaten the tortoises in the wild.

The Galapagos Islands are unique in the incredible variety of creatures that live there. The interactions between each other are very evident in the biological interrelationships that have been going on without interruption for centuries. By studying how these species interact on the Galapagos Islands, one can better understand how other species all over the world evolved.

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Yar Tsa Gumba is a very costly and rarely occurring fungus of enormous medicinal importance. Due to over exploitation, illegal trade, and unprecedented human negligence, Yar Tsa Gumba is on the brink of extinction from its natural abodes in India.

Yar Tsa Gumba

Neglected Fungus Marching Towards Extinction

At the end of June 2011, during our sojourn to Johar Valley in the Kumaun Himalayas, we made out for the first time a few well-preserved specimens of Yar Tsa Gumba at the Tribal Heritage Museum in Munsyari. Later, we found it in a wild state in the Ralam Bugyal near the Ralam village, about 40 kilometers away from the Munsyari Township.

'Yar Tsa Gumba', as it is known in Tibetan, is a very costly and over-exploited fungus belonging to the sac fungi group. It is binomially known as *Cordyceps sinensis* (Berk.) Sacc. The generic name 'Cordyceps' is derived from two Latin words, 'cord' meaning 'club' and 'ceps' meaning 'head'. Among the 600 reported species of the genus, *C. sinensis* is highly valued for its medicinal property.

Cordyceps is believed to provide enormous physical power after consumption. The power of Yar Tsa Gumba was discovered long ago in the Tibetan mountain pastures. Chinese herdsmen observed their cattle and livestock became very energetic after eating a grass-like mushroom. Even the older animals became spry. About a thousand years ago royal physicians

of the Chinese Ming Dynasty, used it to develop powerful potions. Besides, the Chinese and the Tibetans have been using Yar Tsa Gumba as an expensive (as costly as gold!) ingredient of their traditional medicines, since the 15th century.

Cordyceps is a type of entomopathogenic fungus growing parasitically on insects and other arthropods. However, *C. sinensis* parasitizes upon the larvae of Himalayan Bat moth (*Thitarodes armoricanus* Ober) and forms a composite body made up of fungus and insect caterpillar. For this reason, it is commonly known as 'caterpillar mushroom'.

The moth larva forms a cocoon in the winter and finally hibernates in the ground. When the fungal mycelium finds the buried caterpillar, it invades into its body and eventually colonizes the host. The mycelium's growth mummifies the caterpillar, and then forms into a fruiting body that sprouts off the back of the caterpillar's head. The elongated fruiting body, known as ascocarp, is cylindrical, dark brown to black, unbranched (or sometimes branched), and ultimately transformed into a club-shaped stroma. The 'root' of the organism, i.e., the larval body pervaded by the fungal mycelium,

appears yellowish orange to brown in colour. The mature ascocarp bears many small, flask-shaped perithecia containing asci. Each ascus is filled with thread-like ascospores (about 5-10 μ long), which usually break into fragments, taken by the wind during dispersal and are presumably infective to fresh moth larvae.

As the fruiting body of the fungus emerges from the head of the larva in summer and resembles a grass sprout, this fungus is locally referred to as 'keeraghaas'. Its Chinese name 'Yar Tsa Gumba' also supports this feature of the fungus, which means 'winter insect and summer grasses'.

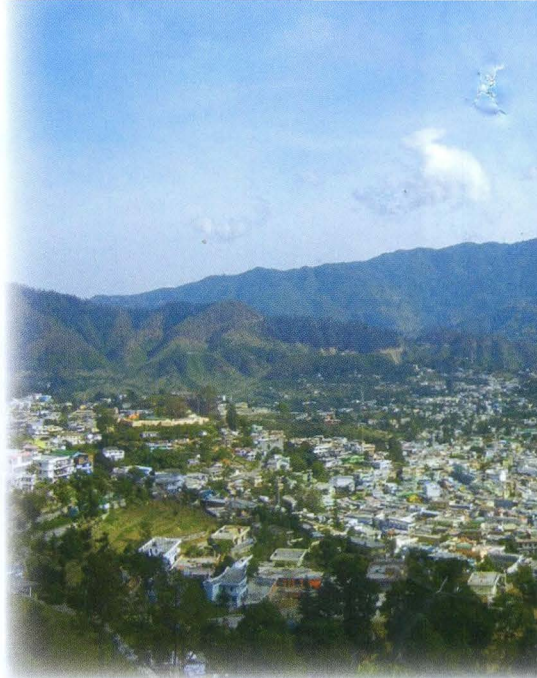
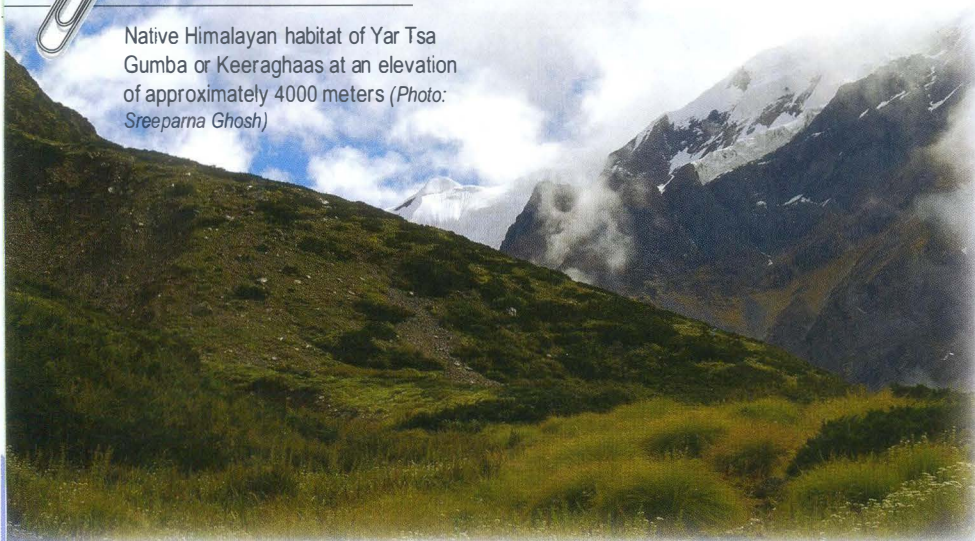
Yar Tsa Gumba needs to be protected from extinction for the sake of the entire human race



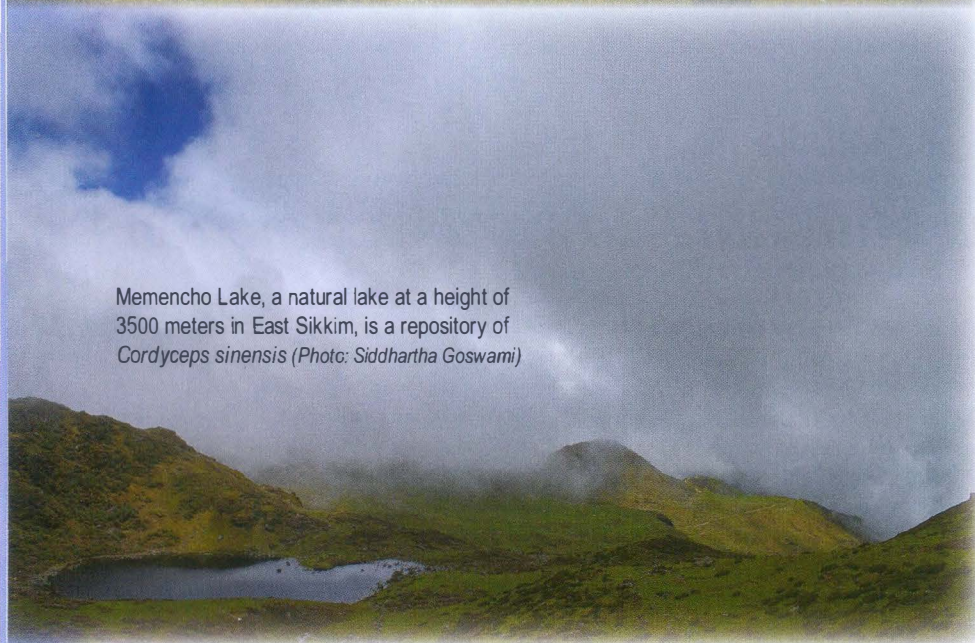


FEATURE ARTICLE

Native Himalayan habitat of Yar Tsa Gumba or Keeraghaas at an elevation of approximately 4000 meters (Photo: Sreeparna Ghosh)



Memchencho Lake, a natural lake at a height of 3500 meters in East Sikkim, is a repository of *Cordyceps sinensis* (Photo: Siddhartha Goswami)



The Relationship Controversy

Although the viable fungal spore is possibly an infectious agent that attacks the moth larvae in establishing a host-pathogen relationship, it is necessary to mention that the entomopathogenic nature of *Cordyceps* is quite disputed. The biological relationship between the fungus and the caterpillar is yet to be settled. Many researchers are of the opinion that *C. sinensis* actually has a symbiotic relationship with the host which is mutually beneficial, rather than pathogenic.

Himalayan bat moths live naturally in a very hostile condition and need 3-4 years to finish their life cycles. In general the moth caterpillar shows six instars, but they may have seven to eight instars in special conditions. The pairing

between the fungus and the caterpillar occurs in a remote as well as inhospitable environment.

Nature tends to select against a parasite, in that a parasite usually results in the death of the host. A more logical explanation for the unique pairing between an insect and this fungus would be that it is a mutually beneficial symbiosis, whereby the moth perhaps gains an energy boost from the *Cordyceps* living in its body, as is known to occur when other animals consume *Cordyceps*.

Natural Abode

Yar Tsa Gumba thrives in cold, grassy, alpine and sub-alpine meadows on the mountainous Himalayan Plateau between 3500-5000 meters above mean sea level. Outside India, it is naturally

found in Nepal, Bhutan, Tibet, and in the Sichuan, Gansu, Hubei, Zhejiang, Shanxi, Guizhou, Qinghai, and Yunnan provinces of China.

In India, *Cordyceps* occurs in a very scattered fashion throughout the Himalayas from Eastern to Western regions including the Central Himalayas. In Arunachal Pradesh, *Cordyceps* is found mainly in the higher altitudes of Tawang area. In Sikkim it is found in areas like Green Lake, Dzongri, Thamej, Menmecho Lake, Nathu La Pass, Doman Valley, and Tholung Pass. Occurrence of *Cordyceps* has been reported from the cold arid environmental zones of Himachal Pradesh also.

However, the most productive region for *Cordyceps* is in the alpine meadows of the Chipla Kedar, Darma, Vyas, and Johar valleys and Ralamdhura in the Kumaun Himalayas. Presently, it is known to be found in various places like Chipla Kot, Brahma Kot, Ultapara, Ghwardharp, Najari, and Nangnidhura in the Dharchula-Munsiyari regions of Pithoragarh District and in the Niti-Mana valleys of Chamoli District of Uttarakhand.

Cordyceps appears annually and its normal harvesting period is between the months of May to July. At the advent of summer, the thawing of snow at the lower altitudes allows the local inhabitants to more easily find the fungus while watching the wild yaks. People believe that the fungus grows where the yaks graze. During July, the fruit body of *Cordyceps* gets maturity and spore dispersal starts. Whether *Cordyceps* also



fruits under the snow in the more severe months or not, is unknown.

Traditional Use

C. sinensis has a long history as a medicinal fungus. There are written records outlining the medicinal uses of this resilient and rare fungus in traditional Chinese medicine since 620 AD, during the Tang Dynasty. However, the first scientifically reliable depiction of the Cordyceps fungus was written in the year 1757, at the time of Qing Dynasty, by a Tibetan scholar Wu-Yiluo in the *Ben Cao Congxin* (a sort of *Materia Medica*).

Yar Tsa Gumba has traditionally been used in China for centuries in various ailments such as in the treatment of kidney, lung, and heart problems; in fatigue, cancer, hiccups, and serious injury as well as male and female sexual dysfunction. It is usually administered

to relieve pain, and the symptoms of tuberculosis and haemorrhoids, to restore general health and appetite, and to promote longevity.

Traditional healers of China also recommend regular use of Cordyceps to strengthen resistance to infections, cure backache and anaemia, and treat colds and flues. It is also used to reduce cough and phlegm, shortness of breath, bronchial discomfort, and asthma.

Unlike other close relatives, such as truffles and morels, the 'caterpillar mushroom' is not usually considered as an edible fungus, because of the tough texture of its stromatic ascocarp as well as the small size and rarity. Traditionally Cordyceps has been consumed with a variety of meats in the form of a medicinal soup. However, Cordyceps is often taken today with some form of vitamin C, which has been found to help the body in its digestion and absorption of the medicinal components of the fungus.

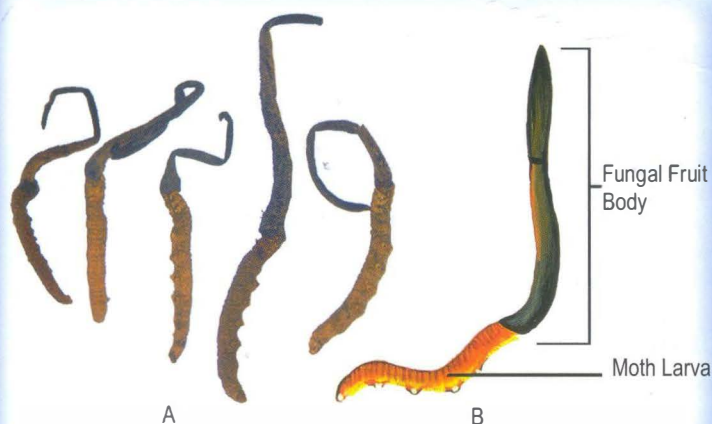
Therapeutic Applications

Modern day medical science has endorsed most of the traditional uses of Cordyceps. It is an aphrodisiac for the body, for both men and women. It is most widely used by two groups of people in our society – athletes and the elderly. Athletes take Cordyceps for jacking up their performance whereas it is often prescribed for the elderly to ease aches and pains as well as to ward off fatigue.

Cordyceps is also used to treat a wide range of health problems such as cardiovascular, pulmonary, and respiratory diseases, renal and liver dysfunction, hyposexuality, and hyperlipidemia. It has been successfully used to protect the bone marrow and liver from damage. Cordyceps is thought to be a remedy for weakness and fatigue and is often used as an anti-depressant for increased energy while recovering from serious illness.

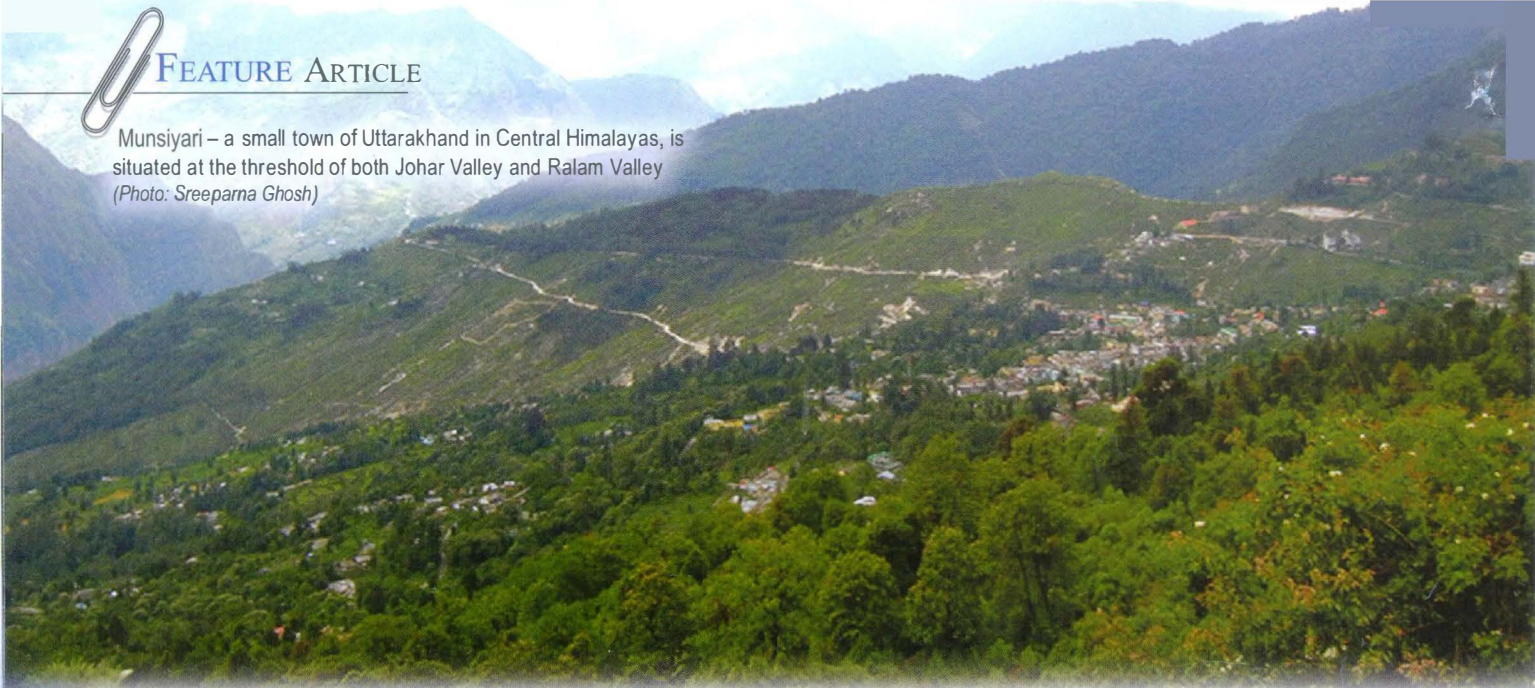
The energy currency or ATP (adenosine tri-phosphate) is an energy packed molecule that actually releases energy in the living cell. Recent research has revealed that consumption of Cordyceps increases both the cellular ATP level and the oxygen availability in our body. So the use of Cordyceps may be helpful to those activities where instant energy input matters. In addition, the increased ATP level and oxygen utilization also helps in lessening high altitude sickness.

The most remarkable feature regarding the medicinal property of *C. sinensis* is perhaps its anticancer and antitumour ability. Cordyceps is currently



YarTsa Gumba: a. Habit of the fungus – Caterpillar association and b. Various parts of the caterpillar fungus (Sketch: Arnab Banik)

Munsiyari – a small town of Uttarakhand in Central Himalayas, is situated at the threshold of both Johar Valley and Ralam Valley
(Photo: Sreeparna Ghosh)



being recommended and used by a growing number of doctors worldwide as it has shown outstanding knack in inhibiting the growth of cells forming malignant tumours. In some cases tumours have been shown to dissolve after treatment with Cordyceps.

Cordyceps is also equally useful for its ability to keep the body strong and vital as it is being devastated by the effects of chemotherapy, radiation and other conventional cancer treatments. Moreover, Cordyceps also boosts the immune system thus preventing infectious diseases.

Bio-chemical Treasure

Cordyceps is a repository of a large number of nutritional components. It contains all of the essential amino acids, vitamins B1, B2, B12, E and K, a wide range of sugars and many different polysaccharides, proteins, peptides, sterols, nucleosides and a wide range of mineral elements such as chromium, gallium, selenium, strontium, titanium, vanadium, zirconium, etc., which are not available even in plants.

Like other fungi, Cordyceps possesses many polysaccharides like cyclofurans, β -glucans, β -mannans, etc., and other sugar derivatives such as cordycepic acid which are reported to have remarkable pharmacological activities like anti-metastatic as well as anti-tumour effects and a hypoglycemic effect that may be beneficial for people with insulin resistance. Cordyceps also contains several polyamines like

cadaverine, diamino propane, putrescine, spermidine, spermine, etc., and a good number of sterols such as campasterol, daucosterol, ergosterol, and sitosterol. Twenty-eight saturated and unsaturated fatty acids and their derivatives have also been isolated from Cordyceps.

Moreover, Cordyceps possesses many uncommon, altered and amazing nucleosides (an incomplete building block of nucleic acid made up of pentose sugar and nitrogenous base) that are found nowhere in nature. Cordycepin, cordycepintriphosphate, deoxyguanine, deoxyuridine, dideoxyadenosine, hydroxyethyladenosine, etc., are some of the nucleosides that have enormous pharmacological importance as potent bioactive substances. Some such substances are the primary antiretroviral drugs used for the treatment of HIV infections.

Yar Tsa Gumba is almost free of any side effects. However, a few people have experienced dry mouth, nausea or diarrhoea, and very occasional allergic reactions after using Cordyceps for the first time. In addition, the effect of Cordyceps on pregnant or lactating women or on very young children is still not known with certainty. Hopefully, its long history of traditional use strongly supports that Cordyceps is a very safe herbal substance with minimal toxicity.

Cordyceps in Danger

Cordyceps is today facing a survival crisis. As it grows in the most inaccessible and secluded areas of the Himalayas, it is

very rarely available naturally. Further, its growth depends on special environmental conditions. The scarcity of the bat moth larvae in the alpine meadows also matters considerably.

Some companies have now developed tissue culture techniques to grow Cordyceps. However, this is a blow to the diversity of Cordyceps.

Besides, a growing number of people are involved in smuggling of Cordyceps. It is believed that 5 grams of Cordyceps is equivalent to 50 grams of 'Panax Ginseng'. China is the biggest importer of Yar Tsa Gumba. In China, Cordyceps is sold at Rs 1, 50,000 per kilogram approximately. The greater part of China's demand comes from India either from Munsiyari to Nepal via Dharchula after passing the Kali river and then to China, or directly from Pithoragarh to China via Nepal.

Yar Tsa Gumba needs to be protected from extinction for the sake of the entire human race. Otherwise in the near future, we shall lose for ever this naturally grown wonder of our unique biodiversity.

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Indian Research Ships

Features and Future

D. RAJASEKHAR,
D. NARENDRAKUMAR,
P.S. DEEPAKSANKAR,
ANANTHAKRISHNA,
K. RAMASUNDARAM,
N. RAVI

Indian research ships today are at par with their international counterparts. Several organizations are employing these well-equipped research ships for surveys, sample collections and an entire gamut of oceanographic research.

OVER the years, India has come to acquire research ships that are versatile ocean observing platforms equipped with advanced scientific equipments and material handling equipments for technology demonstration and oceanic observations, at par with international platforms. In view of future scientific demands, shipboard machinery/equipments and other

associated facilities for oceanic studies are being further improved.

Research ships cater to a gamut of oceanographic research disciplines such as physical, biological, and chemical oceanography; marine geology and geophysics; ocean engineering and atmospheric science. Some of these needs are unique to certain disciplines, while others such as the need to collect seawater samples throughout the water column are more universal.

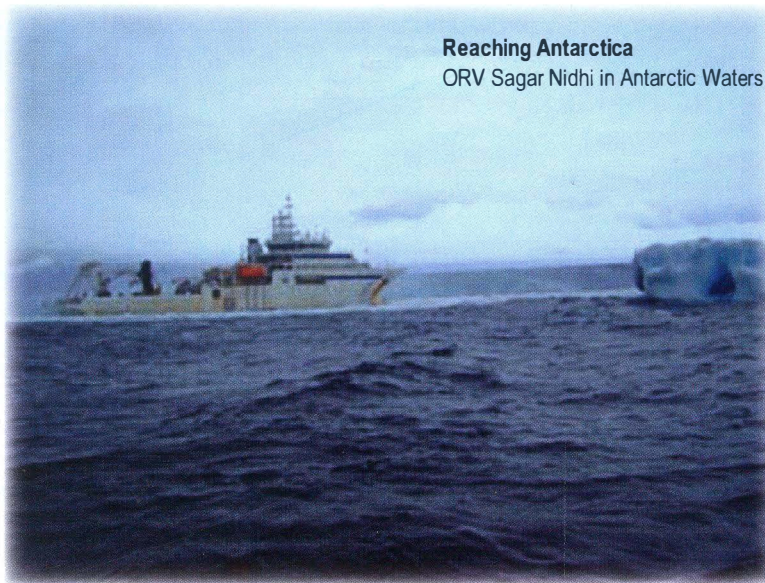
Let's take a look at some of these research ships that are serving the country.

Indian Research Ships

The Ocean Research Vessel (ORV) *Sagar Nidhi* is India's pride – the most sophisticated ice-class research vessel that can accommodate 30 scientists with an endurance of 45 days. It is also the first Indian flagged research ship that reached the 66 S latitude, facing 11 storms and 73 nm/hr wind speed, witnessing nature's harshest conditions and awesome breathtaking sceneries.

Sagar Nidhi is being operated and maintained by the Vessel Management Cell team at the National Institute of Ocean Technology (NIOT), Chennai, an

Reaching Antarctica
ORV Sagar Nidhi in Antarctic Waters



BTV Sagar Manjusha (top)
ORV Sagar Kanya (above)

Research ships are likely to be required to support increasingly complex, multidisciplinary, multi-investigator research, which will drive many aspects of design, including power plant and propulsion, laboratory and working deck layout, over-the-side handling, launch and recovery, and equipment changeover.

8 officers and 10 crew with an endurance of 20 days.

This vessel has many sophisticated facilities such as a winch of 6000 m capacity for launching/retrieval of portable scientific equipments; a CTD (conductivity, temperature and depth) winch of 800 m capacity to collect water samples at different depths; microscope, centrifuge, deep freezer to collect, analyse and store core samples, sediment grab samples and other marine biological and chemical samples. The vessel also has survey equipments like single-beam and multi-beam echo sounders, used for bathymetry survey in the Indian EEZ (exclusive economic zone).

NIOT also has Coastal Research Vessels (CRVs) *Sagar Paschimi* and *Sagar Purvi*, which can accommodate six scientists with an endurance of 10 days. However, since these are almost 16 years old, NIOT is in the process of acquiring two new coastal research vessels. These new ships are proposed to be utilized for shallow water operations along the entire Indian coast for Coastal ocean monitoring and prediction system (COMAPS); Integrated coastal and marine area management (ICMAM); low temperature thermal desalinations (LTTD); drugs from sea, bathymetry survey of EEZ, underwater observation systems and instrumentation, demonstration of various underwater components in shallow water and other surveys.

In the year 1983, under Indo-German collaboration, a multidisciplinary research vessel was built in Germany, christened ORV *Sagar Kanya*, and delivered to the

Ministry of Earth Sciences. This ship is being managed by the National Centre for Antarctic and Ocean Research (NCAOR), Goa facilitated with a versatile ocean-observing platform equipped with advanced scientific equipment and related facilities which support scientific operation. It has completed more than 300 cruises during the 30 years of its service. Recently, the ship completed a 60-day Indian Ocean mission to determine the distribution of selected trace elements and isotopes in the marine environment.

In addition, a large ice breaker Polar Research Ship is under final stage of acquisition by NCAOR, Goa. The principal mission of the proposed ship will be executing oceanographic research works in all the oceans in the world, including Antarctic and Arctic regions throughout the year with state-of-the-art scientific

autonomous institute under the Ministry of Earth Sciences, Govt. of India.

Other research ships of NIOT include *Sagar Manjusha*, a multi disciplinary research vessel, designed by the Indian Maritime University (IMU) Visakhapatnam formerly known as the National Ship Design and Research Centre (NSDRC), and constructed by M/s. Hindustan Shipyard Ltd., Visakhapatnam. With an overall length of 60 m, it has a gross weight of 1075 MT (metric tonne) and a cruising speed of 6 m/s at 90% MCR (maximum continuous rating). It can accommodate 11 scientists,



FORV Sagar Sampada





RV Sindhu Sankalp

CRV Sagar Sukti



RV Sindhu Sadhana

equipments and instrumentation. The vessel will have accommodation facilities for 60 scientists and crew. The ship will be capable of safe embarkation, stowage and delivery of expedition and base support cargo. The ship will be equipped with a flight deck onto which a Super Lynx or similar helicopter can land while the ship is stationary.

The Fishery Oceanographic Research vessel (FORV) *Sagar Sampada* is equipped to carry out multidisciplinary research in oceanography, marine biology and fishery science. The vessel is currently managed and operated by the Centre for Marine Living Resources and Ecology (CMLRE), Kochi, a research institute under the Ministry of Earth Sciences, Government of India.

With an overall length of 72.5 m and ice strengthened, it can accommodate 24 research personnel and 35 crew, with an endurance of 15 days. It acts as a platform for interdisciplinary expeditions in and around the Indian Exclusive Economic Zone, with participation from various institutions, from India and abroad. Built in Denmark, the vessel was commissioned at Mumbai in 1984.

Sagar Sampada has completed many cruises, including one expedition to the Southern Ocean in the winter of 1995-96 for surveying fishery resources in the Southern Ocean.

The National Institute of Oceanography (NIO) with its headquarters at Dona Paula, Goa and regional centers at Kochi, Mumbai and Visakhapatnam, is one of the 38 constituent laboratories of the Council of Scientific & Industrial Research (CSIR), New Delhi. This institute operates a multi-disciplinary research vessel RV *Sindhu Sankalp* originally built as a fishing training vessel (FV *Chisio Maru*) by the Japanese Government. Extensive modifications have been done to convert this fishing training vessel into a research

vessel. It has an overall length of 56.3 m, breadth of 9.1 m and can accommodate 14 scientists with an endurance of 30 days.

Another coastal research vessel, CRV *Sagar Sukti*, converted by acquiring a fishing trawler built in 1990 and now owned by NIO has undertaken 214 cruises for various oceanographic research and survey programmes in the Arabian Sea and the Bay of Bengal, including oceanographic data collection, environmental impact assessment and modeling to predict environmental impact. The institute also provides consultancy on a number of issues including marine environmental protection and coastal zone regulations.

On 31 July 2012, NIO acquired a new multi-disciplinary Oceanographic Research Vessel RV *Sindhu Sadhana*. The ship has an overall length of 80 m, breadth of 18 m and endurance of 45 days and can accommodate 21 scientists. This new ship will greatly enhance the capabilities of Indian oceanographers to make multi-disciplinary observations, with adequate spatial and temporal resolution, enabling them to understand the oceanographic process in the seas around India and to translate this knowledge to benefit the nation.

The Geological Survey of India (GSI) has recently added another feather in its glorious cap by acquiring the RV *Samudra Ratnakar*, a ship designed to meet the fast growing challenges of the modern geo-scientific oceanographic researches as a replacement for existing RV *Samudra Manthan*. This ship is equipped with high-end technologically

advanced instruments needed for geological, geophysical and geochemical explorations in offshore areas. The ship is a unique multitasking and multi-disciplinary ship with modern on-board laboratories designed to carry out sea-bed mapping, mineral exploration, etc. in the deep waters and also research activities.

Manufactured by the Hyundai Heavy Industries, South Korea, RV *Samudra Ratnakar* has the potential to explore up to a depth of 600 metres. Furnished with the latest technological equipments, the ship can sail for 45 days at a stretch and accommodate 73 persons. So far, GSI was carrying out exploration and survey activities in deep sea with the help of cargo ships that were converted for exploration activities.

GSI has surveyed over 95% of the 2012 million sq km of Exclusive Economic Zone (EEZ), including around 1,05,000 sq km of territorial waters of India. These surveys were conducted in Arabian Sea, the northern part of Indian Ocean, Andaman-Nicobar and Bay of Bengal through its three ships — RV *Samudra Kaustubh*, RV *Samudra Shaudhikama* and RV *Samudra Manthan*.

Research Vessels – Key Features

In the coming years, research is likely to be conducted in increasingly remote and environmentally challenging areas, including the Antarctic waters, so the ability to operate with minimal interruptions from the natural elements remains unchanged from the days of the Challenger Expedition.

From left: RV *Samudra Manthan*, *Samudra Ratnakar*, RV *Samudra Shaudhikama*





From left: Launching and Retrieval System, Deep Sea Winch system , Integrated Bridge System of Sagar Nidhi



However, the following areas of functionality are becoming increasingly important in a modern research ship:

Handling Equipment: The safe handling of increasingly large and more complex platforms and instruments over the side in high sea states (up to sea state 6) means that handling arrangements are critical. In the case of *Sagar Nidhi*, the handling gantries, two in number have been designed with a safe working load of 10T and 60T respectively. *Sagar Manjusha* has electro-hydraulic cranes with an outreach of 8 m. Both these ships have a complex suite of electrically driven winches permanently installed, handling 5 cables ranging from 6500 m of steel wire to 10,000 m of synthetic coring rope, as well as 10,000 m fibre-optic tow cable.

In addition, autonomous underwater vehicle (AUV), manned submersibles, remotely operated vehicle (ROV), and remotely operable submersible (ROSUB) require a special Launching and Retrieval System (LARS), which is fitted on *Sagar Nidhi*.

Dynamic Positioning: Dynamic positioning describes the ability of a ship to automatically maintain a stable position through a combination of propellers and thrusters. This enables safe handling of over-the-side packages, and is also critical for accurate navigation of remotely operated vehicles which may be maintaining position on fixed points on the seabed, deployment and retrieval of buoys, deep-sea crawler, etc.

The most fascinating aspect of *Sagar Nidhi* is the ship's dynamic positioning system (DPS) -- DP II class. With the DPS, even at sea state 5, when the wave height is 4-5 m, the ship's position can be fixed to within a variation of less than 50 m. *Sagar*

Nidhi's DP system often is put to work for 3-4 days at a stretch.

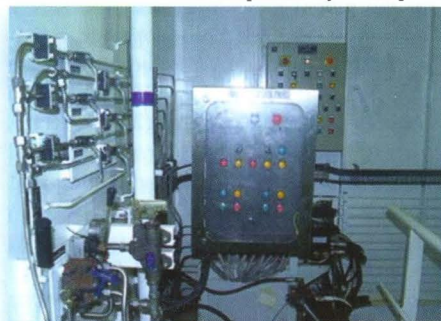
Ice Class: Ships with an Ice Class have a strengthened hull to enable them to navigate through sea ice. Not all ships are built to an ice class. Building a ship to an ice class means that the hull must be thicker, and more scantlings (aggregate of girders, beams, and bulkheads resulting in stronger structural integrity) must be in place. Sea chests (openings in the hull for seawater intake) may need to be arranged differently depending on the class. Sea bays may also be required to ensure that the sea chest does not become blocked with ice.

Most of the stronger classes require several forms of rudder and propeller protection. Two rudder pintles are usually required, and strengthened propeller tips are often required in the stronger ice classes. More watertight bulkheads, in addition to those required by a ship's

normal class, are usually required. In addition, heating arrangements for fuel tanks, ballast tanks, and other tanks vital to the ship's operation may also be required depending on the class.

Hydrodynamic Performance: Although related to acoustic quieting, hydrodynamic performance is somewhat different. Acoustic quieting relates to internally generated sound which can be reduced by providing dampenings/panels of different grade, whereas the hydrodynamic performance is concerned with design features aimed at reducing hull-induced flow noise to avoid interference with scientific equipments.

Laboratories: The wide variety of science activities conducted concurrently means that modern research ships are built with plentiful laboratory spaces, often subdivided into ultraclean, clean, normal, and temperature-controlled areas,



Clockwise from top left: Control system for Drop Keel, Drop Keel arrangement, analysis onboard, Labs in Sagar Nidhi for sample collection



with sufficient flexibility to be used for multiple needs. Specialist laboratory needs are often provided through the use of containerized laboratories, while there is also a requirement for a substantial scientific stores area, including areas for frozen and refrigerated sample storage. The cold room in *Sagar Nidhi* is designed to maintain up to -20 degree Celsius temperature to store the samples.

Working Decks: Research ship working decks are designed with flexibility in mind, with deck areas uncluttered by fittings and as open as possible for fitting of a wide variety of equipment. Ideally, research ships would be designed with low freeboard to facilitate deployment and recovery of over-the-side equipment, but in rough sea this leads to these decks becoming submerged regularly, limiting working conditions, while modern damage stability requirements are leading to higher freeboards. Once again, the design has to be a compromise.



Huge working deck space

Diesel Electric Propulsion: *Sagar Nidhi* has a Diesel-Electric Propulsion system, which means a number of diesel-generators create electricity to supply large electric motors which power the ship's propellers and thrusters. *Sagar Nidhi* carries ample supplies of fuel and numerous types of lubrication oil to keep all engines and other machinery equipment well looked after for the duration of the trip. The ship can carry up to about 900 metric tonne of fuel and engine lubrication oil and sufficient tools and spare parts to maintain the large numbers of equipment on board.

Acoustic Quieting: Many of the sensors on a modern research ship employ acoustic energy, including multibeam



Sagar Nidhi maintaining position at mid-sea using DPS

echosounders, Acoustic Doppler Current Profilers (ADCP) and underwater positioning and telemetry systems. Such systems operate at an optimum level when acoustic interference is minimized. This is required in some ships to avoid disturbance to fish (to ensure accurate biomass measurements).

Much of a ship's noise comes from its machinery, so double raft mounting and/or resilient mounting of this machinery is employed, while the design of the ship's propellers also has a major effect. These ships operate 24-hours a day, so more and more ambient internal noise around cabins has to be controlled using design approaches generally used in cruise liners.

Communication Equipments: Radio communications of short, medium-wave and intermediate broadcast band as well as modern satellite equipment are used for communication among vessels and shore services. All of them are components of the global marine distress and safety system (GMDSS). Ship communication equipments include VHF Radiotelephone (156-162 MHz), Radar, EPIRB, Single sideband Radiotelephone (2-27.5 MHz), Satellite Radio, Radiotelegraph, Survival Craft Radio, On Board Radio etc., that provide two-way communication within a ship and communication with shore, other ships, and airplanes. Ships may communicate with other ship stations or coast stations primarily for safety, and secondarily for navigation and operational efficiency.

Sagar Nidhi is equipped with fleet broadband system for effective voice/data communications using satellite. Recently, live webcasting was done successfully from mid-sea to shore using sailor fleet broadband system onboard *Sagar Nidhi*.

Scientific Equipments: NIOT's research ships come with a range of in-built equipment that the scientists will use on a cruise viz. CTD Rosette (CTD with water Sampler 12 Bottles upto 6000 m depth), Auto analyzer, Chlorophyll Analyzer, Laminar Flow, Auto salinometer, Spectrophotometer, Thermosalinograph, Electronic Balance, Magnetic stirrer, Millipore water purification plant, vacuum pump with filter manifold, Hot plate, Automatic weather station, Gravity Corer (1.5m & 6m length), Weiner Grab, Zoo plankton net and so on, to name a few. These systems are vital to enabling measurements to be taken and samples to be collected, and without them conducting research would be a lot more difficult.

Modifications on NIOT Fleet

The team of scientists in the Vessel Management Cell (VMC), NIOT has been working to improve the reliability of the Dynamic Positioning System, which has won the prestigious National Maritime Award for technological innovation.

Innovative engineering solutions were implemented on *Sagar Nidhi* for better operational convenience. For instance, the sanitary system has been modified by incorporating "reducer elements" to reduce failure rate. EVAC system is modified for "Isolation" of decks for better "Trouble Shooting".

Anti-roll tanks installed on Sagar Manjusha



An experimental study has been carried out in order to improve the sea-keeping qualities of *Sagar Manjusha*. An anti-roll tank was fabricated and installed on the boat deck which considerably reduced the rolling motion (from 21.80 to 7.10).

Misalignment of 11 mm on the LOS (line of sight) of *Sagar Purvi* propeller shaft was corrected with an engineering technique without replacement of propeller shaft bracket. This method is now a part of "IRS Standard approvals".

Underwater Shell-plate renewal of *Sagar Sakthi* (dumb barge) was carried out for the first time in India, without dry-docking the ship (in floating condition) under IRS.

Old and condemned propeller shafts of CRVs *Sagar Paschimi* and *Sagar Purvi* were also "Clad welded" by an innovative engineering method and re-used on CRVs.

Constraints for Indian Research Ships

Dedicated berthing facility: Ship berthing is the reservation of a location to allow them to complete, in a timely manner, re-provisioning, repair, maintenance, training, and certification tests prior to redeploying for future operational commitments.

On the contrary, ocean research organizations like JAMSTEC (Japan), NIWA (New Zealand), UNOLS (Rhode Island) and Hobart Laboratories (CSIRO, Australia) have dedicated quay for their research ships.

Sea-front facility: A sea-front facility on the seacoast would work on various applications and technologies aimed at utilizing ocean resources. NIOT's projects like low temperature thermal desalination, deep-sea technologies, remotely operable vehicles and deep-sea submersibles, ocean observation systems and ocean acoustics etc., require a sea-front facility to undertake activities like development of prototype systems, validation of indigenously developed marine systems and testing of various sensors/components.

Benefits of having a seafront facility include reduced transportation cost, reduced downtime by having dedicated berthing for NIOT ships, real time test facility for various sensors/components, etc.



Berthing Facilities for JAMSTEC and CSIRO Ships

Seafront facility for LUMCON and NOAA

Louisiana universities marine consortium (LUMCON) provides coastal laboratory facilities to Louisiana universities, and conducts in-house research and educational programmes in the marine sciences. LUMCON's (member of UNOLS) primary facilities are located at the DeFelice Marine Center in Cocodrie, approximately 85 miles southwest of New Orleans. This location, situated within the estuarine wetland complex of the Mississippi River delta plain between the Atchafalaya and Mississippi Rivers, provides ready access to the most productive estuaries in the United States, to a variety of coastal environments, and to the open Gulf of Mexico. To provide additional access to special environments, a field station is maintained at Port Fourchon.

NOAA's Western Regional Center (WRC) is located in Seattle on Lake Washington, adjacent to Seattle's Warren G. Magnuson Park. The complete Western Regional Center consists of nine buildings which contain 473,938 square feet and a vessel staging pier. Three of the buildings provide offices and laboratory facilities for NOAA components and a fourth is a multi-purpose auditorium.

Future of Indian Research Ships

The limitations of remote sensing mean that, for the foreseeable future, ships will remain the primary method of conducting oceanographic research, both through direct observation and through deployment and recovery of sensors, moorings, and vehicles. At the

same time, research ships are likely to be required to support increasingly complex, multidisciplinary, multi-investigator research, which will drive many aspects of design, including power plant and propulsion, laboratory and working deck layout, over-the-side handling, launch and recovery, and equipment changeover. Because technology changes rapidly and ship life-spans are long, future research ship designs will need to be highly flexible.

NIOT's VMC team is working on increasing operational time of ships to 330 days/year by employing innovative engineering techniques to reduce time for breakdown and preventive maintenance without compromising on the performance of the ships, to develop team for operation and maintenance of scientific equipments, ROV, LARS and manned submersible on *Sagar Nidhi* and to establish a permanent berthing facility for MoES research ships at the Chennai harbour.

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D. Narendrakumar, P.S. Deepaksankar, Ananthakrishna, K. Ramasundaram, and N. Ravi are also with the Vessel Management Cell, NIOT

“Triple Jeopardy”

AADI SHARMA

“Zachary, are you there?”

It was 8 AM and I'd barely put my uniform on. Six years later and I still felt proud putting on the shiny leather and steel clothing, like a child with a new toy. It was optimized for combat and yet was very lightweight.

“Hey, this is important. They say they've got a big job for you today.”

The voice came from the sleeve of the uniform. I took a look at the tiny computer near my left wrist. I only saw the reflection of my face first, a rugged, clean shaven face with short, dark hair. Despite the advanced technology, I still loved using my wrist computer as a mirror to see if my hair looked alright. I then clicked a button for it to accept someone trying to connect to me. A crystal clear image of a smart-looking man with dark brown hair appeared on the small yet distinct screen. It was Blake, the only colleague I talked to on a regular basis.

“A big one today, Zach. Get here quickly.”

I sighed and replied, “Okay, okay. I'll be there as usual.”

I finished getting ready and left my apartment. I got into my car and set the destination for the Special Forces Headquarters in the military district a little outside the city. It was about seventy miles away, but took twenty minutes to reach. I stepped out of the car and looked at the grand, imposing building. It wasn't long until I got past the routine identification check and up to my office. As soon as I entered my wrist computer buzzed again and I heard Blake's voice once more.

“You've arrived, right? I told you that you've got a big task on your hands today. Don't waste any more time. Marshal wants to speak to you.”

I wondered if this job Blake kept talking about had to do with the big project that everyone keeps murmuring about. The government and absolute top tier people at the Special Forces have been working on, rumour has it, a very large-scale project.

I took the elevator to Marshal's office. He was the chief of field operations of the Special Forces, the part of the forces which go out and do the dirty work such as shooting, chasing and arresting criminals. As I entered, he was looking out of the window with his back turned to me.

“Your job,” Marshal began to speak while still facing away, “is to go and eliminate Shane.” He was never one to mince words.

“Shane? Did they finally find him?” I asked. Shane was a rather well-known anarchist responsible for a fair number of bombings

First time in the night that I thought seriously about the situation I was in. Shane is a criminal. He has killed people, and I have worked for the Special Forces for six years. But is the government really planning wars?

and inciting riots. Like a suave thief straight out of an action movie, he always eluded the special forces.

“This isn't another false lead, is it?” I continued.

“No. After months of work and sifting through information we've finally traced him for real.” So for once this isn't something that has been reported by a giggling teenager trying to get into the news, I thought.

I didn't question him further. When Marshal says something, he truly means it. He wouldn't make a big deal over this if it wasn't true.

“We believe you're the best man for this job,” he turned around and spoke, “We don't want to send a big team in. He moves quickly, and even a moderately large operation will be too risky. He'll find out and will just disappear again.”

The thought of going alone to kill an experienced criminal weighed heavily on me. There was also a bigger problem: I had never taken a life before. I had always shot thieves, smugglers and the like in non-lethal areas. In the worst cases they'd just be injured enough for the team to capture them and take them away. I knew that capturing was far too risky with Shane. Everyone thinks that killing is easy when you work in a field like this, but it never is.

“I know what you're thinking; you've never killed before, but you've been chosen as your record is spotless. You've always been quick and efficient when it has come to dealing with thugs, and that's why you rose through the ranks so fast.”

*I heard my doorbell ring.
I answered the person at the door using
my cell phone while still sitting in bed
which was connected to the house's
internal network, like the door was.*

*I panicked a little,
as it sounded a tiny bit*

I felt a pit in my stomach, but I didn't even consider backing out. I am a man, not a quivering boy. Without wasting any time, I asked all the details I needed for the job. Shane was going to meet someone at a scrap heap thirty five miles outside the city at about 7 PM tonight, and provided that I'm as efficient as I usually am the job would be done with just a single shot of my laser pistol.

I turned to leave. "Good luck, Zachary. Remember, do not hesitate," were the words I heard as the elevator doors closed.

As I walked through the roomy reception on my way to the exit, I met Blake.

"There you are, Zach. On your way to the job, I see," he spoke cheerily.

"Yeah. I'd assume they'd keep it a bigger secret, though. How come you knew this was going to happen?" I inquired.

"What, so you think you're the only one who should be kept in the loop, eh?"

"That's not what I meant." I side-stepped the question, "Anyway, is this the big project that the higher-ups have been working on?"

"We-e-ll..." he dragged out his response, "I can't say for sure."

I expected as much. If this was the big project, then the higher-ups would only make the information public after the job was done, so the only way for me to find out was to get the ordeal over with.

"I should probably get going now. I do have a few hours to spare, but I shouldn't slack on a crucial job like this."

"Yeah, okay. Good luck, Zach."

I reached the junkyard within a couple of minutes. I parked my car away and had it auto drive about a mile away just so that nobody in the vicinity would see it. I waited behind one of the smaller scrap heaps. It was only 2 PM, but the next few hours just flew by. At 6:52 PM, after the sun had set, I saw him. The unmistakable silhouette of Shane. There didn't seem to be anybody else there.

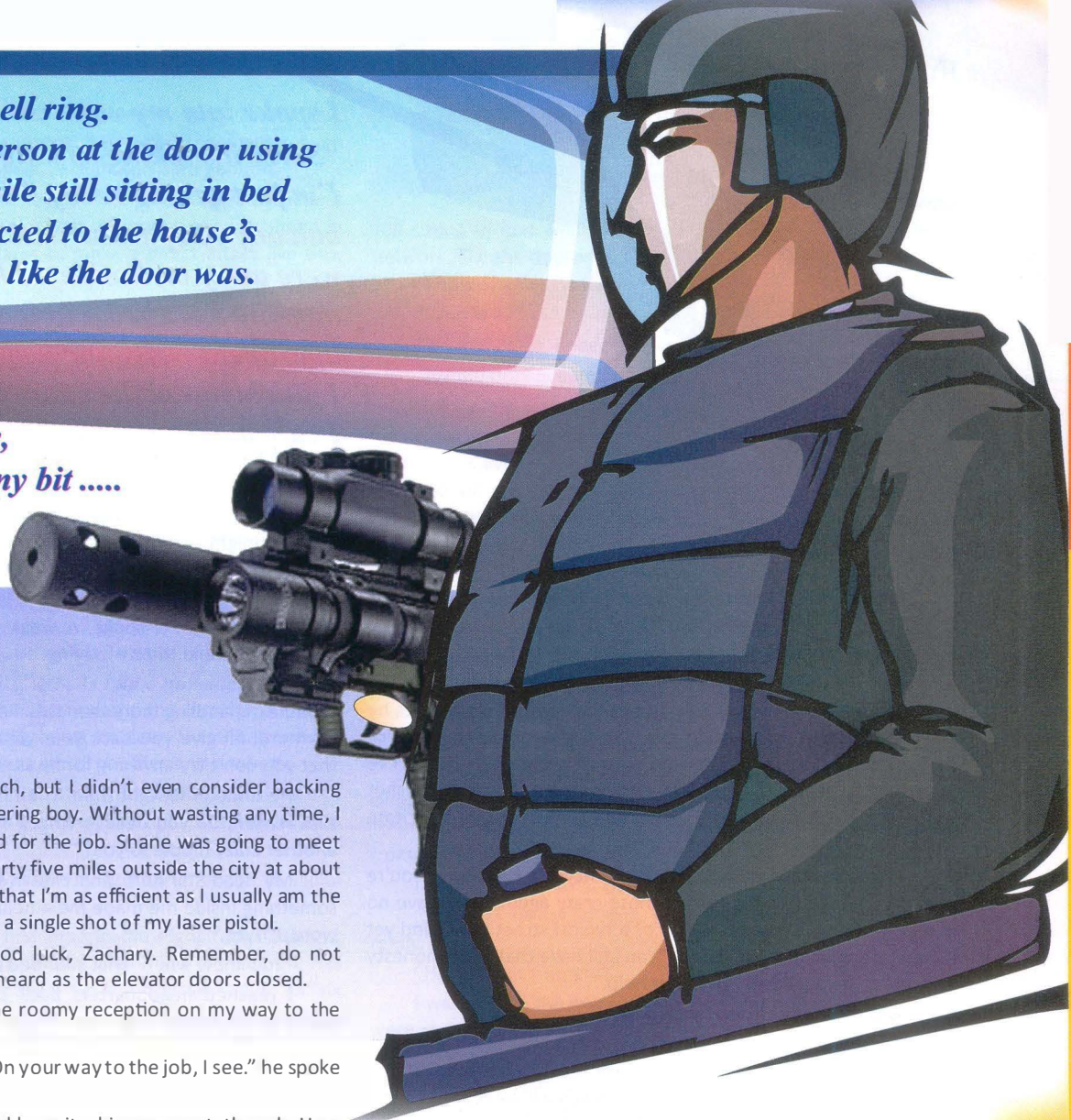
I rose from the shadows and took aim. He heard me and turned around, and I saw a man with medium-length blonde hair and a worn face with bags under his eyes who dressed a little better and cleaner than the image of a ragged urchin I had in mind. I panicked a little internally, but my hand didn't quaver. I said "I'm sorry," and pulled the trigger. The energy bolt from my pistol hit him between the eyes with a loud zap and he fell over.

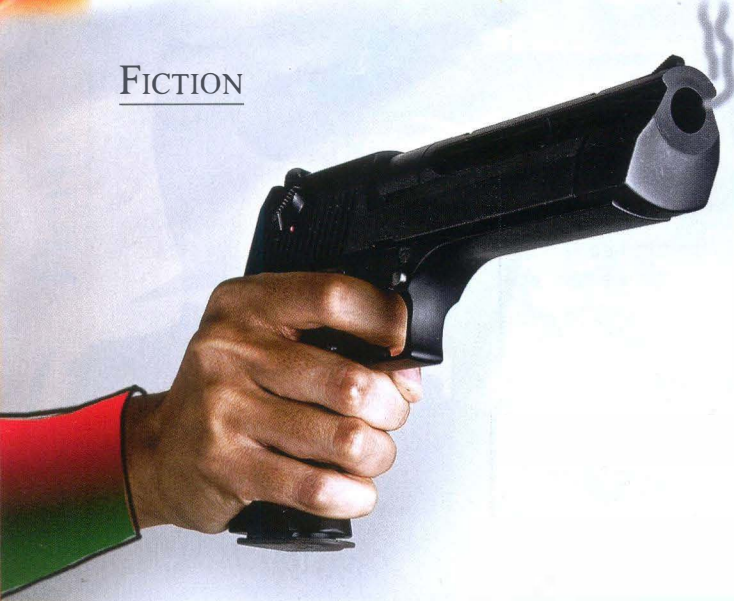
The deed was done. I moved back to the edge of the scrap yard and signalled my car to drive back to where I was. Strangely, the approximately ten-minute wait for the car to arrive felt longer than the few hours I waited for Shane to appear.

And then something hit me hard on the head from behind and I fell unconscious.

When I came to, I was tied up. The protective force field of my suit had been disabled too. My ears were ringing and my head was hurting.

"Well well. Look who's finally awake." It was almost pitch black, but I could make out that it was none other than Shane sitting across me. I realized we were still in the scrap yard. I was rather surprised that I wasn't dead yet. Perhaps he wanted to use me as a hostage?





He turned his head towards the stripes on my sleeve. "You know," he started to speak again; "this was a pretty good operation. They sent an expert to dispose of me quickly and efficiently. It would have gone perfect had you not underestimated my defenses."

I realized how stupid I was. I noticed now that the clothes he was wearing were military clothes with the same defensive force field capabilities as mine, the kind normal people don't have. I've never had to deal with a criminal equipped like this. A direct shot to the head from just a pistol would only temporarily incapacitate someone with this equipment at best.

"I like you, though, which is why I haven't killed you. You're not brainwashed like the rest of those crazy agents who have no empathy." His voice was like that of a typical street punk, and yet he seemed cool and calculated. "You still have that bit of honesty and mercy in you. I could use your help."

I was utterly confused by his words.

"They're planning something big, this government you work for. I've had multiple sources tell me over the past few months that they're working on some big weapons which will be ready in a few years, and are going to start a war or something."

I still couldn't bring myself to say anything.

"Do you even talk? I didn't hit you that hard. Speak up, man."

"I-I d-don't want to h-help you..." I muttered.

"I expected that answer. Now hear me out. I know how they must be giving me an awful name in the news and all, but the real evil is the big guys working on all the warfare stuff. I can wager that you might have noticed some shady and big secrets being kept in your headquarters."

He was right. But I couldn't give him the satisfaction of saying yes.

"I can't convince you right away, but I need you to be my inside man. I can tell you're not like the others; you'd be willing to listen to both sides of any argument. There's going to be a big war soon, and you an' me, pal, are the only ones who can stop it."

I squeaked out a reply, "What if I say no?"

"Then I can kill you right here, right now." I expected as much.

As much as I disliked criminals and condemned crime no matter what the cause, there was an element of truth in what he was saying. Could the 'big project' be something quite like what Shane described?

"Alright, I-I'll help you." I croaked.

I spoke into my wrist computer.

"Sorry it's taking so long, I was in the bath. I'm just getting ready." I was now in the balcony of apartment 183, and the tenants were away on holiday. I had my gun with me, and I blasted a hole through the weak apartment walls and went inside. Then I quickly used the stairs to get downstairs. I called my car and drove away.

"Good! I think we'll get along just fine. Now here's the plan. You go back and report that you took care of everything. And later after midnight, we're going to infiltrate the headquarters where you work with your help and find out their secrets, and put a stop to it."

"I-I'm tired..." I spoke. A weak response, but there wasn't much else I could think of saying.

"Oh come on now, champ. I know that you agents are capable of handling more than this. Remember, we aren't enemies anymore. I'll give you back your weapon, but without ammo so that you don't try anything funny as soon as I untie you."

He untied me right then. Then he gave me a hard stare and said "Listen, do you believe what I'm saying? Or do I sound like another crazy hippie to you?"

My head still hurt, and I wasn't in a position to think. But something inside me made me a heartfelt reply consisting of one word: "Y-yes."

"You know what? That sounded genuine. Off you go."

I reached headquarters back by 9:30 PM. My head was spinning even now. The first person I met when I walked inside was Blake.

"That took longer than expected," he spoke, "Are you alright? You look dazed. Your first kill, huh?"

"Yeah..." I muttered.

"I need to talk to you, come with me."

I went to his office, and then he said something that shattered my daze completely.

"I know about your conversation with Shane. I planted a bug on your sleeve before you left. Sorry about that."

I couldn't reply. I could go to jail on charges of sedition.

"No, no, don't look so upset. I know that was the only thing you could have replied to him to get him not to kill you. See, this is a perfect opportunity for us. You can lead him right where we want him and then bam! We corner the slippery snake."

I shook myself back to alertness. I couldn't be distracted at a time like this.

Blake continued, "I haven't told anyone yet. I'll keep a crew of field agents ready with me. When you lead him inside, give me the signal. I'll inform Marshal too, and we'll trap him. Remember, though, we can't prepare for his arrival too much or else he'll suspect something. I also don't know how he'll proceed once inside the headquarters. There are lots of exits out of the place and thus a lot of ways he can escape, so although this sounds unprofessional, I'll have to rely entirely on your signal before striking, Zach."

"Alright." I responded with confidence. Fake confidence, really. I was playing triple agent here now, or maybe even quadruple agent. I couldn't bear to think too hard about it.

Past midnight, I got a message from Shane. It told me to meet him behind the headquarters. There are never any patrolmen in this area, as no anarchist dares to make a direct attack like this. Except Shane, apparently.

"My matter-analyzer device tells me that this wall is weak. I can blow it open with this bomb. It's a wonderful technology, really, as it won't even make a sound!" he said.

A portion of the wall silently crumbled. We headed inside.

"Show me the way to Security Minister Derek's office."

Derek's office? I would think that Shane would want to go to the data room, the conference room, or the room with the mother computer.

"If you're wondering, it's because the other areas are too risky. The Security Minister's office will likely contain the information we need, and yet isn't a place where your agents would suspect anyone would look."

I have to hand it to him, he's pretty smart.

We made our way up to Derek's office in no time. I would scout ahead and signal when nobody was in the corridor, and then Shane would pass through silent as a shadow. There was nobody inside. Shane began sifting through all the files and drawers.

"Hm... there's certainly interesting information here. I haven't found exactly what I'm looking for yet, but there's still enough to make the public revolt."

And now I realized it was the perfect time for me to signal Blake to attack.

This moment was the first time in the night that I thought seriously about the situation I was in. Shane is a criminal. He has killed people, and I have worked for the Special Forces for six years. But is the government really building weapons and planning wars? Something does seem to not be right around here. Shane has already said that he's found things that would make the public go crazy. Is he lying to keep me on his side, or is it the military that is corrupt here? Should I take a look at the files he's talking about, or...?

But Shane was a criminal... right? I stopped hesitating and in a moment of willpower forced myself to click the button to send Blake the signal through my wrist computer. It was all over. The decision was done. Soldiers burst in through the two doors leading into the room.

"Well done, Zachary," came Marshal's voice. I saw Blake behind him with a smile on his face.

"You! You betrayed me!" Shane screamed. They had already used an EMP device to disable Shane's weapons, and then three soldiers handcuffed him.

"Just you watch! They'll think you know too much of their secrets! They'll come tearing your house down and the next thing you know you'll be a corpse floating down some river! And then the war will start some years later! It's all your fault...!" Those were his words he said to me before they took him away kicking and screaming like a child whose mother didn't let them have their way.

I couldn't sleep that night. I helped in arresting a most wanted criminal. But was that the right choice? The impact of my decisions kept going through my head. And Shane's final words kept

playing in my mind, too. Would there really be a war now, because of me?

I heard my doorbell ring.

I answered the person at the door using my cell phone while still sitting in bed which was connected to the house's internal network, like the door was. I panicked a little, as it sounded a tiny bit like how Shane said things might turn out for me.

"Who is it?"

"It's me, Blake. I need to talk to you."

"H-hold on, I'm coming."

"Why are you sounding nervous? Come on, answer the door."

I was literally shaking, and felt more scared and helpless than I did all day, even more than when Shane had me tied up. They've come to kill me, haven't they? Just like Shane said! They think I might know too much! But wait, am I being paranoid? Maybe Blake just wants to talk about the day's events, or something. Or ask me if I'm feeling alright, after all the pressure I went through today. But at this late hour? Maybe this is my last night alive...

"Zachary! Answer the door! Let me inside!"

I regained my composure for just a second. I did what I could: took all my precious belongings, clothes and any money I had lying around and stuffed them in a bag.

"I'll be right there, Blake, hold on."

It was insane, but I went to the balcony of my apartment, and climbed over to the neighbour's balcony without looking down. Then I climbed some more balconies until I was far enough away from my own apartment.

I spoke into my wrist computer.

"Sorry it's taking so long, I was in the bath. I'm just getting ready."

"Hurry up, it's urgent!"

I was now in the balcony of apartment 183, and the tenants were away on holiday. I had my gun with me, and I blasted a hole through the weak apartment walls and went inside. Then I quickly used the stairs to get downstairs. I called my car and drove away. I didn't even set a destination, just set it to travel as far away as possible.

It has been one and a half years since then. I now live in another city hundreds of miles away in another country, with a new name. I managed to find work and a house with cheap rent here. The first eight months were tough, but now I'm settled in.

I still look back, thinking what came over me. Did I abandon my old, very successful life over simple paranoia? Or did this crazy, impulsive decision save my life? Were there really weapons being developed and because of my decision, would a war start within the next few years? Only time will tell, and I don't think these questions will stop pestering me anytime soon.

I don't really know what happened to Blake or Marshal or anyone at the Special Forces headquarters. They probably have the resources to track me down, but since I worked for them for six years I know exactly what to and what not to do to leave behind no trace of my previous life.

I'm happy now, but that decision will always haunt me. It all feels like a distant dream now.

Contributed by Aadi Sharma, Class X, The Shri Ram School, Moulisari, DLF Phase III, Gurgaon, Gurgaon-122002

Imported Plight

Invasive Alien Weeds of India

RIDDHI DATTA

FOR months now Hari Achanta, 31, has been waking up every morning and going into sneezing fits. On lucky days, he averages 50 sneezes and on others more than 100 and feels miserable for the rest of the morning. As he whizzes around the city on his motorcycle for his interior decoration business, the feeling only gets worse.

Achanta's problem: he lives in Bangalore, praised as India's greenest and most beautiful city... But the spreading parthenium weed has effectively demolished Bangalore's credentials as the country's most liveable city." (*India Today*, April 30, 1993)

'Parthenium today is familiar to most of us and is rapidly establishing itself as an 'imported plight' in India. However, Parthenium is not alone. India has sheltered hundreds of such alien invasive weeds and Parthenium only tops the list. Non-indigenous plants that escape cultivation and become agricultural pests, replace native plants, adversely affect human and animal wellbeing and alter the ecosystem are grouped as alien invasive weeds. Let's have a look at some of the most dangerous alien invasive weeds of India.

Parthenium hysterophorus

This deadly weed is presenting severe peril to agronomy and also to human and animal health all over the globe. This weed is native to Tropical America. It was first spotted in Pune in 1956. It had



Imported plight: *Parthenium hysterophorus*

voyaged from the USA with wheat seeds and gradually spread across the country. Biswas in his review, *Some foreign weeds and their distribution in India and Burma* (1934) rightly predicted: "The American plants seem to have particular liking for the Indian soil, so that once they set foot on any part of India they spread like wild fire in no time."

Since its arrival, Parthenium has become the most threatening weed in India. The weed is common along roadsides, around agricultural fields and on wastelands. The allelochemicals released from the weed or from seed leaching impede growth of grasses, legumes, cereals, vegetables and even trees.

Parthenium also alters the physical and chemical properties of soil like its texture, pH, contents of organic matter, nitrogen, potassium, phosphorus, etc. It is unpalatable to grazers and adversely affects animal health damaging milk and meat quality. Another significant threat from this weed is that it can cause dermatitis, hay fever, asthma, allergy and even death in humans.

Several control measures are being taken to inhibit Parthenium invasion including use of herbicides like Paraquat to biocontrol agents like insects and co-evolved fungal pathogens. Several Indian research institutes have initiated collaborative projects to commendably check invasion of this weed. In a survey by Gnanavel (2013), it has been pointed out that infestation of this weed causes yield losses up to 40% in several crops and reduces forage production by up to 90% in India which makes the situation alarming.

Lantana camara

This verbenaceous shrub with gorgeous bright-coloured flowers is a native to American tropics. The advent of Lantana to India occurred much before in 1809 as an ornamental, and was noted as a hazardous invasive weed since the turn of the century. Remarkably, Lantana

can catch fire even when green and is considered as a potential fire hazard in dry deciduous forests.

Lantana also competes with agricultural crops and hinders growth of other plants, a phenomenon known as allelopathic effect. This weed is reported to be a major concern in teak, eucalypt and coffee plantations of India. Its foliage contains pentacyclic triterpenoids which cause hepatotoxicity and photosensitivity among grazers.

The Global Invasive Species Information Network now categorizes Lantana among the top ten invasive species in the world. Various approaches have been employed to control the spread of Lantana. Serious attempts have been made by the Forest Research Institute, Dehradun to identify insects that feed on this weed.

In a recent research article entitled *A Battle Lost? Report on Two Centuries of Invasion and Management of Lantana camara* L. in Australia, India and South Africa, the authors state, "...governments in Australia, India and South Africa have taken aggressive measures to eradicate Lantana over the last two centuries, but these efforts have been largely unsuccessful. We found that despite control measures, the invasion trajectory of Lantana has continued upward..." (Bhagwat et al 2012).

Mikania micrantha

Mikania micrantha, also known as Bitter Vine, is a tropical plant and native to the sub-tropical zones of North, Central, and South America. This plant was introduced in India after the Second World War in



Chromolaena odorata
in full bloom

Left:
All that glitters: Camouflaged as an
ornamental *Lantana camara* started its
journey in India

**The Global Invasive Species
Information Network now
categorizes *Lantana*
among the top ten
invasive species in
the world. Various
approaches have
been employed to
control the spread of
Lantana.**

the 1940s. Within a year it showed lavish
growth in Kerala and Assam affecting
forests and tea plantations damaging
ecosystems and impairing economy of
the country. By 1980 *Mikania* had already
invaded other Indian states.

It exhibits strong allelopathic effect
owing to the presence of sesquiterpenoids
in its foliage. Numerous field crops
like sugarcane, maize, rice, pineapple,
cotton, coffee and forestry crops like teak,
eucalyptus are being suppressed owing to
the prolific spread of this weed.

Several attempts have been made
to identify suitable biocontrol agents
against *Mikania* but in vain. Several 2,
4 D compounds are active against this
weed but its toxic action on biota and
long persistence make it unsuitable as a
control agent.

Mikania micrantha: A flowering twig



Chromolaena odorata

Christmas Bush or Devil Weed is a
weedy shrub indigenous to America from
southern USA to northern Argentina.
After its advent as an ornamental plant
to India in the early 1840s, it has spread
throughout Southeast Asia, into parts of
Oceania and West and Central Africa.
Chromolaena odorata, as it is known to
the scientific community, is a severe
peril in grasslands, forests, orchards and
commercial plantations particularly in
coconut, rubber, oil palm, tea, teak, coffee
and cardamom plantations.

In the early 1990s, the IOBC Working
Group on *Chromolaena odorata* was
formed, and since then, biocontrol of
the weed has been a global effort. The
ACIAR program in Southeast Asia in
the 1990s effectively established gall fly,
Cecidochares connexa, as a biocontrol
agent throughout Southeast Asia, parts
of Oceania and other countries, including
India. This has permitted reducing the
invasive nature of the weed in many areas
with high rainfall.

Eichhornia crassipes and *Salvinia molesta*

Water hyacinth (*Eichhornia crassipes*) is
a free-floating aquatic plant native to
tropical and sub-tropical South America.
This weed was introduced to India as
an ornamental pond plant from the
Amazon Basin and has become a menace
in the backwaters of Kerala. It covers
water-bodies radically affecting water
flow, obstructing sunlight from reaching
native aquatic plants, depleting dissolved
oxygen and often killing fishes or turtles.
This weed also creates a prime breeding
ground for mosquitos and habitat for a
species of snail known to host a parasitic
flatworm which causes schistosomiasis.

Salvinia molesta, commonly known
as giant salvinia is a free-floating aquatic



Water hyacinth: A close view (above)



A close up view of *Salvinia molesta*

fern, native to south-eastern Brazil. This
highly aggressive, competitive species
made its entry into India before 1900 and
has become a serious concern among
paddy cultivators in the state of Kerala.
Several mechanical, chemical as well as
biocontrol measures have been taken to
check invasion of these weeds but till
date these measures have proved to be
insufficient.

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For the last three years, reviews of the results of the Indian Premier League cricket tournaments have confirmed that the “best” teams of the respective tournaments were crowned the champions. Once again this year we review the results of IPL-7 2014, but now using an improved understanding.

Subsequently, we also make an effort at understanding the results of the English Premier League football tournament that concluded this year on 11th May.



The Best Team at IPL 2014 and EPL 2013-14

GANGAN PRATHAP

IN the Indian Premier League cricket tournament this year, there were only eight teams in the fray. A total of 56 matches were needed to complete the round-robin stage, i.e. each team had to play the other twice. The four “best” teams at the end of this stage which were chosen by the IPL promoter’s rules to go into the playoff rounds were: Kings XI Punjab (22 pts), Kolkata Knight Riders (18), Chennai Super Kings (18) and Mumbai Indians (14).

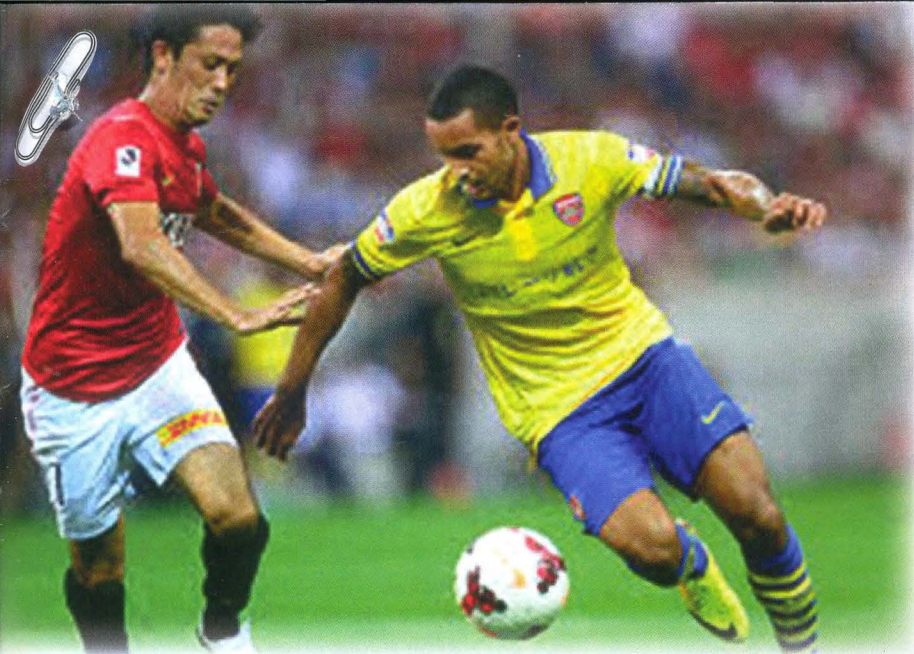
Although Kolkata Knight Riders (KKR) and Chennai Super Kings (CSK) were tied at 18 pts each, the latter were placed ahead because of a superior net run rate (+0.418 compared to +0.385). Rajasthan Royals also had 14 pts at the end of this stage but Mumbai Indians (MI) were placed ahead, again because of a superior net run rate (+0.095 compared to +0.060) and moved on to the playoff stage.

Unlike earlier years we use a slightly more sophisticated interpretation of the paired-comparison problem during the round-robin stage. The Kendall-Wei scheme for tournament ranking [T.H. Wei, *The algebraic foundations of ranking theory*, Cambridge University Press, London, 1952] [M.G. Kendall, *Further contributions to the theory of paired comparisons*, *Biometrics* 11 (1955), p. 43] is a process of recursive iteration to find the strongest among the strong teams. Points are given according to the strengths of the team beaten. As this is not known beforehand, the raw scores are improved until the weighted scores are obtained, and at each stage, the “strength” of the team is revised until a stable, converged value is reached.

The IPL organizers use the simplest row-sum procedure to rank the teams: 2 points are given to each team that wins, a tie or a no-result (e.g. a match abandoned due to rain) earns 1 point and no points for a loss to get the raw scores. That is, the IPL scheme is based on raw scores obtained from adding points uniformly irrespective of the strength of the team that was overcome. Compared to this, the KW scheme is a weighted scheme, the weighting improving progressively as the iteration continues recursively.

On the night of 25 May 2014, each team had played the other twice, for a total of 56 matches. Table 1 shows the raw and weighted scores at this stage. Thus, the top four teams here are the same that the IPL promoters chose to go to the playoff stage and in the same order!

On the night of 1st June 2014, Kolkata Knight Riders overcame King’s Eleven Punjab (KXIP) to lift the trophy a second time. By this time, KXIP had played 17 matches, KKR and CSK 16 matches each and MI had played 15 matches.



The four teams actually chosen by the IPL promoters to go to the play-off stage have to play another four matches at the playoff stage, two qualifiers, an eliminator and a final.

This year's season came to an end on Sunday, 11 May 2014 with Manchester City clinching the title for the second time in three seasons.

Implementing this is no more difficult than the Kendall-Wei approach and can be done with a few iterations on an Excel spreadsheet. Table 2 shows that when Ramanujacharyulu's protocol is implemented in a recursive manner and rankings are performed in an ascending order, we get quite unexpected results. Mumbai, which was quite erratic throughout does not get through to the play-off stage! Rajasthan Royals does.

TABLE 1:
KW Weighted Score Rankings at the end of the 56 matches, as on 25 May 2014

Ranking	Raw	KW
Kings XI Punjab	22	21.51
Kolkata Knight Riders	18	18.98
Chennai Super Kings	18	17.56
Mumbai Indians	14	15.49
Rajasthan Royals	14	12.85
Sunrisers Hyderabad	12	10.88
Royal Challengers Bangalore	10	9.07
Delhi Daredevils	4	5.66

We had promised that this year we would introduce a slightly more sophisticated and subtle way of looking at the paired-comparison tournament ranking problem. This is because the

arguments about rankings in a paired-comparison tournament do not end with Kendall-Wei's protocol.

A half-century ago, an Indian mathematician named Ramanujacharyulu (C. Ramanujacharyulu, Analysis of preferential experiments, *Psychometrika*, 3 (1964), pp. 257-261) pointed out that there is yet another way to look at a paired-comparison problem. The Kendall-Wei method tries to find which is the most strong among the strong teams. Mathematically, this looks at the matrix formulation of the problem in a row wise manner. Ramanujacharyulu suggested that given the same paired-comparison matrix, we can also try to find out which was the least weak among the weak teams. The mathematical protocol now handles the same matrix formulation of the problem in a column wise manner.

TABLE 2:
R Weighted Score Rankings at the end of the 56 matches, as on 25 May 2014

Ranking	Raw	R
Kings XI Punjab	6	6.99
Chennai Super Kings	10	9.28
Kolkata Knight Riders	10	10.94
Rajasthan Royals	14	12.99
Sunrisers Hyderabad	16	14.89
Mumbai Indians	14	15.82
Royal Challengers Bangalore	18	16.72
Delhi Daredevils	24	24.37

Thus, if recursive algorithms are seen as being more rigorous than simple raw counts, we have the intellectually unsatisfying situation where the two schemes can produce different rankings. There is a simple way out of this dilemma using an elegant solution proposed by Ramanujacharyulu. The "most-balanced" point of view is obtained by trying to find out who can combine the greatest ability to win with the least susceptibility to lose.

In Ramanujacharyulu's own words, "in tournaments one may be interested in locating the really talented man (sic) in the sense that he has won over the largest number of opponents but simultaneously he has been defeated by only a few opponents."



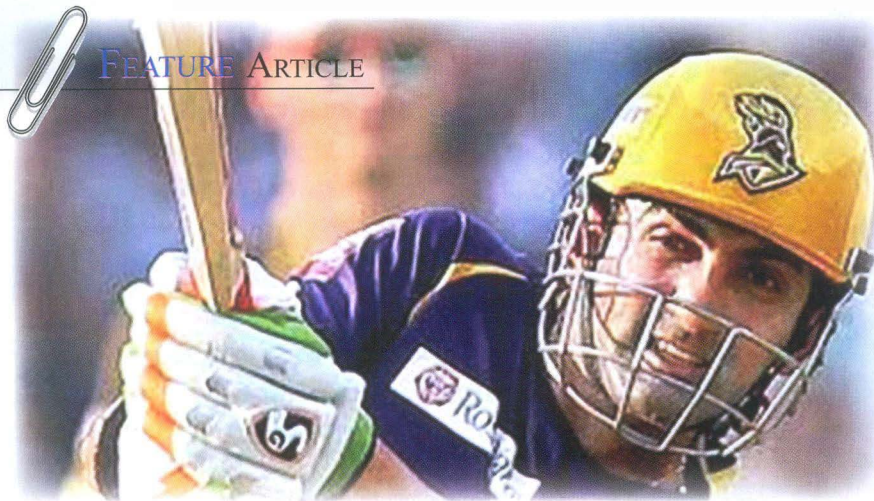


TABLE 3:

The teams at the end of the round-robin stage of the IPL 7 2014 season using Ramanujacharyulu's power-weakness ratio: *Chennai ranks ahead of Kolkata and Rajasthan edges out Mumbai by the thinnest of margins.*

Ranking	KW	R	P-W Ratio
Kings XI Punjab	21.51	6.99	3.08
Chennai Super Kings	17.56	9.28	1.89
Kolkata Knight Riders	18.98	10.94	1.74
Rajasthan Royals	12.85	12.99	0.99
Mumbai Indians	15.49	15.82	0.98
Sunrisers Hyderabad	10.88	14.89	0.73
Royal Challengers Bangalore	9.07	16.72	0.54
Delhi Daredevils	5.66	24.37	0.23

Table 3 shows the revised rankings for the teams at the end of the IPL-7 2014 season using Ramanujacharyulu's power-weakness ratio. Chennai now ranks ahead of Kolkata and Rajasthan edges out Mumbai by the thinnest of margins.

The four teams actually chosen by the IPL promoters to go to the play-off stage have to play another four matches at the playoff stage, two qualifiers, an eliminator and a final. On the night of 1st June 2014, Kolkata Knight Riders overcame King's Eleven Punjab (KXIP) to lift the trophy a second time. By this time, KXIP had played 17 matches, KKR and CSK 16 matches each and MI had played 15 matches.

The Kendall-Wei and Ramanujacharyulu algorithms allow the recursive iteration to be continued over these additional games as well. This is reflected in the final standings shown in Table 4. KKR's two victories over KXIP have not been enough to close the gap – although KKR

collected the title, it was KXIP which was the outstanding team over the 60 matches that were played during this latest IPL season!

Next, we move on to football. The English Premier League is perhaps the most closely followed football league in the world. This year's season (EPL 2013-2014) came to an end on Sunday, 11 May

Although Kolkata Knight Riders and Chennai Super Kings were tied at 18 pts each, the latter were placed ahead because of a superior net run rate (+0.418 compared to +0.385). Rajasthan Royals also had 14 pts at the end of this stage but Mumbai Indians were placed ahead, again because of a superior net run rate (+0.095 compared to +0.060) and moved on to the playoff stage.

TABLE 4:

Power-Weakness Ratio Rankings at the end of the 60 matches, as on 1 June 2014

Teams	KW	R	P-W Ratio
Kings XI Punjab	23.71	10.12	2.34
Kolkata Knight Riders	24.58	11.07	2.22
Chennai Super Kings	19.02	11.12	1.71
Rajasthan Royals	13.28	13.82	0.96
Mumbai Indians	14.85	16.95	0.88
Sunrisers Hyderabad	10.17	15.28	0.67
Royal Challengers Bangalore	8.43	17.09	0.49
Delhi Daredevils	5.94	24.55	0.24

2014 with Manchester City clinching the title for the second time in three seasons.

There are 20 teams in the Premier League and each team plays the other twice, once at home and once away. So in all 380 (i.e. 20×19) matches are played. Each team is given three points for a win and in a drawn match two points are shared at a point each by the teams.





The English Premier League is perhaps the most closely followed football league in the world.

This year, in 38 matches, Manchester City collected 86 points, two points ahead of the next placed team, Liverpool. With such a clear finish at the top there was no need to look for goal differences to resolve a tie. Or was it a clear undisputed finish as one would be led to believe from all the sports coverage on this event?

Regularly now for the last three years, in *Science Reporter* we have shown that the method of giving three points (or two points for a win as is the case with the cricketing IPL series) is not fair. Such a protocol does not give points according to the strength of the team that has been beaten. So let us use the same argument to review this year's EPL season to see if Manchester City was indeed the "best" team.

There were twenty teams in this year's double round-robin tournament with a total of 380 matches. To find the "best" team in the tournament we shall again use the Kendall-Wei scheme for tournament ranking. Presently, the EPL points are based on a simple raw row-sum procedure to rank the teams, where 3 points are given to each team that wins, a tie is shared at a point each and no points for a loss. In this simple formulation, a team got the same 3 points for beating the best team or the worst team. On the other hand, the KW scheme is a weighted scheme, where points are recursively iterated depending on the strength of the team beaten.

Table 5 shows the top 5 teams at the end of the EPL 2013-2014 season according to the official rankings. Manchester City is indisputably at the top. It is also relevant to point out that on both occasions that Manchester City played Chelsea it was the latter that got the upper hand. This will have a bearing on what follows.

TABLE 5:

Top 5 teams at the end of the EPL 2013-2014 season according to the official rankings

EPL	KW-Row
Man City	86
Liverpool	84
Chelsea	82
Arsenal	79
Everton	72

If the Kendall-Wei recursive algorithm is used to weight each team according to its own strength, then Chelsea will get more points for a win over Manchester City than Manchester City would get for a win over Cardiff or Fulham! The Kendall-Wei algorithm can easily be implemented using an Excel spread-sheet and a few iterations are all that are needed to get a converged solution. Table 6 shows the change in placings. It is Chelsea which is right at the top!

TABLE 6:

The top 5 teams at the end of the EPL 2013-2014 season if the Kendall-Wei recursive algorithm is used

EPL	KW-Wt
Chelsea	90.91
Man City	89.62
Liverpool	85.79
Arsenal	76.66
Everton	71.52

It would have been intellectually pleasing if the argument about rankings in a paired-comparison tournament ended with Kendall-Wei's protocol. But let us once again use Ramanujacharyulu's protocol, as we did in the case of IPL-7. Table 7 shows that if we use a simple column sum addition of the raw points and rank them in ascending order, there are no surprises when compared with Table 5 for the top five spots.

TABLE 7:

Top 5 teams at the end of the EPL 2013-2014 season using the "least weak" argument and raw points counts.

EPL	R-Row
Man City	23
Liverpool	24
Chelsea	25
Arsenal	28
Everton	33

However, when Ramanujacharyulu's protocol is implemented in a recursive manner, we get quite unexpected results as seen from Table 8.

TABLE 8:

The top 5 teams at the end of the EPL 2013-2014 season if the Ramanujacharyulu recursive algorithm is used.

EPL	R-Wt
Liverpool	22.07
Arsenal	23.98
Man City	25.57
Chelsea	30.76
Everton	31.19

Thus, if recursive algorithms are seen as being more rigorous than simple raw counts, we have the intellectually unsatisfying situation where Chelsea ranks at first place in the KW (row wise) procedure and Liverpool is at the top in the Ramanujacharyulu (column wise) procedure. Is there a way out? Ramanujacharyulu had actually proposed one. The "most-balanced" point of view is obtained by trying to find out who can combine the greatest ability to win with the least susceptibility to lose.

Table 9 shows the revised rankings for the top 5 teams at the end of the EPL 2013-2014 season using Ramanujacharyulu's power-weakness ratio: Liverpool was the team that was most likely to win and the least susceptible to lose.

TABLE 9:

The top 5 teams at the end of the EPL 2013-2014 season using Ramanujacharyulu's power-weakness ratio: Liverpool was the team that was most likely to win and the least susceptible to lose.

EPL	P-W Ratio
Liverpool	3.89
Man City	3.51
Arsenal	3.20
Chelsea	2.95
Everton	2.29

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Prize
Puzzle



THE BEAR

A bear walks south for one kilometer, then it walks west for one kilometer, then it walks north for one kilometer and ends up at the same point from which it started. What colour was the bear?



Answer:

There are three prizes of Rs 500/- each for three correct entries. In case of a large number of correct entries, the prize winners will be selected through a draw of lots. The decision of the Editor, *Science Reporter* will be final.

Send your entries to:

Puzzle Corner

Editor, *Science Reporter*

National Institute of Science Communication & Information Resources (NISCAIR)

Council of Scientific and Industrial Research (CSIR)

Dr KS Krishnan Marg, Pusa Campus

New Delhi-110012

**Last date for the
entries to reach us:
05-09-2014**

Name :

Address :

Pin code:

Age : Email: Sex:

Occupation : ☐ Student ☐ Housewife ☐ Teacher ☐ Professional ☐ Retired ☐ Other

Educational level : ☐ Primary ☐ Secondary ☐ Graduate ☐ Postgraduate

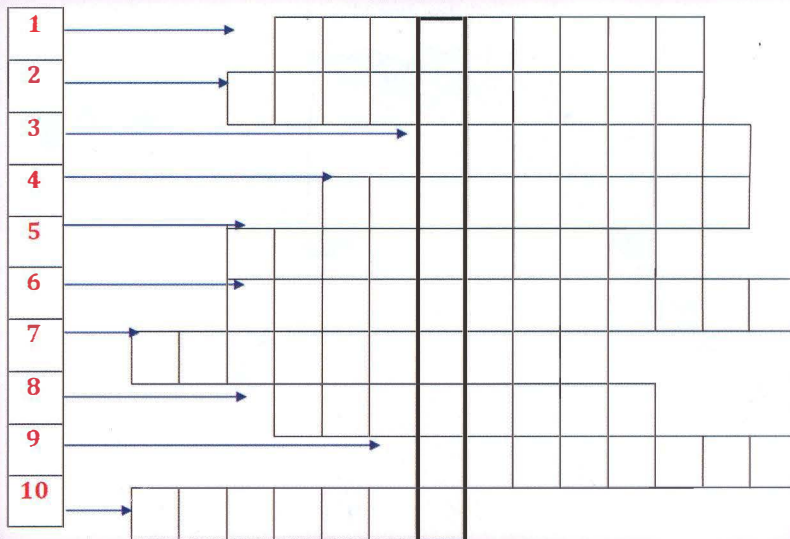
- Please fill up the questionnaire at the back
- You can send your answers on a photocopy of this page as well.

SOLVE THE CLUES

Based on the clues given below fill up the grids from 1 to 10. Once you fill up the grid you will get a term signifying the study of enzymes in the dark boxes.

Clues:

1. The study of bones
2. Branch of science that deals with the study of resistance of organisms against infection
3. Study of animals
4. Study of algae
5. Branch of science that deals with study of insects
6. Study of microorganisms, including viruses, prokaryotes and simple eukaryotes
7. Branch of science that deals with study of skulls
8. Study of cells
9. Science of genes, heredity, and the variation of organisms
10. Study of how organisms interact with each other and their environment



Down: _____

Contributed by Sindhe Veera Sivaji, LIG-71, 2-126, Housing Board Colony, Medchal, Ranga Reddy, Telangana-501401; Email: sivajibio@gmail.com

ELECTRICITY TERMS

In the grid below, search for 15 electricity-related terms (given vertically, horizontally, upwards, backwards).

L	E	S	P	O	W	E	R	V	Z	B	C	O	L	D
C	W	A	T	T	M	S	R	G	I	H	T	A	J	E
P	K	K	Y	T	L	N	C	U	R	R	E	N	T	H
E	C	N	A	T	S	I	S	E	R	N	O	Y	F	T
R	H	E	N	C	H	A	R	G	E	R	A	L	R	R
O	C	O	N	D	U	C	T	O	R	C	M	O	D	A
T	K	J	I	C	A	T	M	R	O	A	P	N	J	N
A	I	N	V	E	R	T	E	R	E	P	E	S	C	S
L	T	Y	V	N	G	S	L	K	W	A	R	T	T	F
U	J	T	O	M	H	O	N	B	V	C	E	I	T	O
S	V	C	S	S	U	T	E	L	I	I	R	B	L	R
N	T	P	T	I	U	C	R	I	C	T	O	N	O	M
I	R	R	E	S	I	T	A	N	U	O	U	O	V	E
I	N	D	U	C	T	A	N	C	E	R	S	E	T	R

Contributed by Hemen Hazarika,
Amingaon Electrical Sub-Division, Amingaon, Guwahati, Assam-781031

Solutions to the puzzles published in the June 2014 issue

Prize Puzzle:

NUMBER PUZZLE

The number is 45

THE TISSUE ISSUE

- | | |
|----------------|----------------|
| 1. PHLOEM | 2. SCELENCHYMA |
| 3. PARENCHYMA | 4. FIBRE |
| 5. SCLEREID | 6. NECTARIES |
| 7. COLLENCHYMA | 8. XYLEM |
| 9. HYDATHODES | 10. LATICIFER |
| 11. CAMBIUM | 12. TRACHEARY |

The name in the vertical box will be **MERISTEMATIC**.

The prizewinners based on the draw of lots from among the correct entries are:

- Nishkarsh Agrawal, HIG-44, ADA Colony, Phase-I, Ramghat Road, Aligarh-202001 (UP)
- Soumya Hembram, Charapole (Near Primary School), Post Kampa, Dist. 24 Parganas (N)-743193
- Tanya Sharma, B-821, Gali No. 26, Sant Nagar, Burari, Delhi-110084

Congratulations all the winners!

Colugos are solitary animals and completely arboreal. They cleverly pick the trees that they perch on. These trees usually contain spotted white spots that correspond with those on the colugo's body.

Flying Colugo

DID you know that these tiny, gliding, tree-loving animals have the same ancestors as the Anthroidea, that is, apes from the New and Old Worlds, including human beings? We are more closely related to these flying lemurs than we are to half-apes.

There are two species of colugo: The Philippines Colugo and the Malayan Colugo. The Philippines colugo is endemic to the Southern Philippines, while the Malayan Colugo occurs in Indo-China, Thailand, Indonesia, Malaysia and Singapore.

An adult colugo generally weighs about 1000 grams to about 1500 grams (1 kg to 1.5 kg). The length of the animal is between 330-420 mm (33 cm to 42 cm) with a tail of around 175-270 mm (17.5 cm to 27 cm). The fur coating of males is observed to be more of a reddish-brown colour.

The most distinctive feature is a skin membrane called Patagium, which

connects the thin arms, legs, neck, and digits on both the hands and legs. It looks somewhat like a wing and is used for gliding purposes, to enable the animal to move from tree to tree in search of food. It functions similar to a parachute. The hands and feet of the colugo are spread widely, and each limb is equipped with strong recurved claws. The claws enabled the animal to climb and perch vertically on the trunk of trees. Large eyes and stereoscopic vision provides good depth perception and aids greatly in night vision.

Although often called the flying lemur, the colugo does not fly nor is it a lemur. It belongs to a unique family called Dermoptera, which means the "skin-winged". It is not exactly known how the name of flying lemur came about. Probably early identifiers found that the colugo had a dog-like head.

Colugos feed on leaves, flowers, buds and fruits. Food is brought to the mouth by hand in very much the same way as the apes. They obtain vital water sources from food and by licking wet leaves.

The young stays attached to its mother for several weeks and is carried around in her hammock-like membrane, which is formed from the flank and the tail portion of the patagium.

Colugos are solitary animals and completely arboreal. They cleverly pick the trees that they perch on. These trees usually contain spotted white spots that correspond with those on the colugo's body, for example the Silverback and Sea Apple trees. Being a slow moving animal, the colugo thus camouflages itself to keep away from predators like eagles and Man. When threatened it can move very fast among the trees.

Colugos mate all year round and a single young is usually born after a gestation period of 60 days. The young stays attached to its mother for several weeks and is carried around in her hammock-like membrane, which is formed from the flank and the tail portion of the patagium. This serves to protect the young during glides and it also helps to "hide" the young to avoid unnecessary attention from Man and predators.

Due to the rapid destruction of their natural habitat, the colugo population has been dwindling in the past decade. Colugos are also considered as pests in banana, coconut, palm and rubber plantations, where they eat the reproductive flowers, buds and fruits of the trees, which is why they are persecuted indiscriminately by plantation owners.

Efforts to breed and rear the colugo in captivity have not been successful so far. Perhaps it can be attributed to the fact that the flying lemur only feeds on certain plant species and it is very difficult for the animal to obtain enough nutrients for its diet.



(Picture courtesy: Mrs. Minal Pandey,
collected from 100 Years of Calcutta Zoo)

SHAKUNT PANDEY

Sanyal urged for the establishment of a marine zoological station on the coasts of Bengal. He writes, "Artificial fecundation by mixing eggs and milt together is practically unknown in India. An Aquarium will offer to naturalists splendid opportunities for carrying out researches on this line."

Unsung Man of Science

Ram Brahma Sanyal

1851-1908

RAM Brahma Sanyal has the credit of writing the first ever book on the management of animals in captivity. He was the first full time director of the Calcutta Zoo. This too is a remarkable feat because in those days of British rule an Indian heading an institution run by a Managing Committee comprising members of European origin was unheard of.

During his superintendence, the Calcutta Zoo became a pioneer in captive and cross breeding of animals. Some very rare feats were achieved like the birth of a hybrid Sumatran rhinoceros in captivity – a cross between Hairy Eared/Northern Sumatran Rhinoceros (*Rhinoceros lasiotis*) and the Sumatran Rhinoceros (*Rhinoceros sumatrensis*).

The international science journal *Nature* described him as "one of the very few natives of British India that have exhibited any taste for natural history."

Sanyal did not have a formal degree in zoology or botany but his love for science made him undertake treatment of sick animals as well take remedial measures to make the life of animals living behind iron bars as comfortable as possible. He was the corresponding member of the Zoological Society of London being the second Indian to have been elected thus. He was also the Associate Member of the Asiatic Society of Bengal and enriched both the reputed organisations with his fine articles on zoology.

His eye for observation of animals was rare. This is reflected in his acclaimed *Handbook of Management of Animals in Captivity in lower Bengal* as well as the articles that he contributed for *Proceedings of the Zoological Society of London* and the *Proceedings of the Asiatic Society of Bengal*. Recognising his contribution to zoology and management of captive animals the imperial government of India honoured him with the title of "Rai Bahadur" which was equivalent to the Order of the British Empire (OBE) and bestowed to individuals who had done great service to the nation.



During his superintendence, the Calcutta Zoo became a pioneer in captive and cross breeding of animals.

Sanyal was born in 1851 in Berhampore district of Murshidabad. He descended from the 'Varendra' Brahmin families and his ancestors were spiritual guides of the Rajas of Lalgola. After completing his earlier education from the Berhampore Collegiate School he came to Calcutta about 1870 as a student of the Medical College, but had to drop out.

Early in his life Sanyal evinced a spirit of activity in research which attracted the attention of Kanhai Lal De, a scholar of chemistry. He availed Sanyal's services in the compilation of his Bengali work on chemistry 'Kimiti Nigudharth' (1871). In the *Journal and Proceedings of the Asiatic Society of Bengal* (1908) Sanyal reminisces: "In 1873-74 the writer of these notes had the privilege of dissecting, under proper guidance, a large number of fish of various kinds."

The turning point in Sanyal's life came with the construction of the Calcutta Zoological Gardens. He was recruited to a very junior position as an assistant to Dr. George King, the superintendent of the Royal Botanic Garden. As King was a botanist of repute the task of laying out the garden and landscaping was assigned to him. While laying the landscapes and gardens of the zoo Dr. King imparted practical lessons in botany to him. Sanyal learnt a lot from Dr. John Anderson, the acting superintendent of the zoo, as well.

Despite Sanyal's satisfactory superintendence of the Zoo, the committee wanted a European to be at the helms of affairs at the zoo. The minutes of the committee meeting held on 19 July 1877 stated: "Babu R.B. Sanyal is unfit to have the job of management of the Garden and that it is necessary to approve a European head keeper..." The management committee failed in finding a European Superintendent and ultimately bowing to Sanyal's prowess he was appointed Acting Superintendent in 1879 and made permanent Superintendent a year later.

In the Resolution of the Government of Bengal for the year 1888-89 Sir Stuart Bayley, the Lt. Governor of Bengal, suggested that from the records of the committee and "the recollections of their able superintendent" it would be possible for them to produce a handbook which would be of interest to the scientific world and to persons interested in zoology.

Based on his observations in housing common as well as exotic animals and methods employed to keep the animals and birds at the zoo in sound health and his experience in handling those animals, Sanyal wrote the handbook in 1892. In the preface

of the book Sanyal writes: "Should this book fall into the hands of any European Naturalist or Manager of a Vivarium, I trust that he will consider the fact that it is intended for India, where trained supervision is a desideratum."

This work made the scientific community of the world sit up and take notice. *Nature* reviewed Sanyal's work on 4 August 1892: "Considering the number of zoological Gardens in Europe, and their long establishment, it is singular that it should have been left to the superintendent of a zoological Garden at Calcutta, and to a native of India, withal, to produce the first practical handbook on the *management of animals in captivity*." "On the whole we must allow that this volume is a remarkable production, considering the circumstances under which it has been produced, and that its author deserves great credit for the pains bestowed on its composition, and for much valuable information contained in it."

Noted Ornithologist of his time Frank Finn who had devoted his book titled *Garden and Aviary Birds of India* to Sanyal, opined in *Hamlyn's Menagerie magazine* in May 1917: "His own book on the management of animals in captivity in lower Bengal is the best that has been published in any language, and reflects credit alike on the practical zoological attainments and command of English of the writer." Recognising his contribution in enrichment of zoological Science and scientific attainments the Zoological Society of London elected him a Corresponding Member in 1893. In those days being a corresponding member of the Zoological Society was a big deal and people used to flaunt this distinction like degrees accompanying their names.

His article in the *Proceedings of the Zoological Society of London (P.Z.S.)* 1894 shows his keen observation, "The acquisition by the Zoological Garden, Calcutta of a *Cynogale bennetti*, Gray, from Borneo, has enabled me to have a water colour sketch made of this interesting mammal whilst alive.... On referring to the literature of the species I find that the animal has been figured by S. Muller (*Zool.Ind.Archip. mamm.pl.xvii*) under the name *Potamophilus barbatus*, and by M.M. Eydoux and Souleyet (*Voyage de la bonite, mamm.pl.vi*). But a comparison of the present sketch with the figures given by the above named authors will at once show that their figures could not have been drawn from life, and that both are practically useless for the purpose of identification."

In 1894, Commissioner of the Bombay municipality deputed the Head Animal Keeper of the Victoria Gardens J.M. Doctor to visit Calcutta and undergo training under Sanyal for a year.

TO MY FRIEND,

RAI R. B. SANYAL, BAHADUR, C.M.Z.S.,

Superintendent of the Calcutta Zoo,

I DEDICATE THIS BOOK.

Dedication by Frank Finn in his book *Garden and Aviary Birds of India*, 1915

Sanyal did not have a formal degree in zoology or botany but his love for science made him undertake treatment of sick animals as well take remedial measures to make the life of animals living behind iron bars as comfortable as possible.

Recognising his contribution to zoology and management of captive animals the imperial government of India honoured him with the title of “Rai Bahadur”

Sanyal's last article for the Zoological Society appeared in the P.Z.S. 1895 regarding observation of the Great Bird of Paradise. Sanyal writes, "In his remarks on the moulting of the Great Bird of Paradise (*Paradisea apoda*) recorded in the P.Z.S. (p 392), Mr. Bartlett questions the statement of Dr. Guillemard, made upon the authority of the inhabitants of the Aru Islands, that the Great Bird of Paradise 'does not wear its adult plumage all the year, and that its beautiful plumes remain developed for not longer than two or three months'. I have had opportunities of observing the habits of two adult males of the Great Bird of Paradise for a sufficient length of time to justify me in stating that, although it is difficult to make the phenomenon fit in with the previous notion of the law of moulting in birds, it is nevertheless the fact that my observations regarding the moulting of the bird, extending over a period of four years, go to show that there is some truth in Dr. Guillemard's statement."

During the period 1895-96, Sanyal along with D.D. Cunningham conducted experiments on the action of various antidotes to snake venom. Experiments on the idea of Calmette and Fraser, that the serum of an animal immunised against cobra poison will not only protect against this poison but also against the poison of other snakes was conducted. Cunningham acknowledges Sanyal's help: "I have only once more to record my deep obligations to the superintendent of the Zoological Garden, R.B. Sanyal, C.M.Z.S., without whose willing and intelligent co-operation it would have been a matter of extreme difficulty to have conducted these investigations satisfactorily." (Scientific Memoirs By Medical Officers of the Army Of India Part X 1897)

Sanyal wanted his countrymen particularly the younger generation to take interest in science and with an aim to kindle the passion of science in the youth he wrote *Hours with Nature* in 1896. This book too was reviewed in *Nature* (November 1896) where it is regretted "other observations on the habits of animals under his care have not found a place in this volume." Such was Sanyal's knowledge about animals that people could not have enough of him.

The Indian Museum's Centenary volume (1814-1914) also recommended this book: "Here we may mention an interesting little book, the late Rai Bahadur R.B. Sanyal's *Hours With Nature*, in which considerable space is devoted to a tour of the zoological galleries of the museum...., but with an originality and quaintness of its own."

Sanyal harboured a dream of visiting European countries and their Zoos to gain firsthand knowledge. His long cherished dream was fulfilled when he was sent as a delegate to the Fourth International Congress of Zoology held in Cambridge from 22nd to 27th August 1898. Out of the three delegates representing British India he was the only "Native". The other two delegates H.M. Phipson and J.C. Wroughton were both Europeans working in India.

In *The Avicultural Magazine*, Vol II, 1903-04 W. Tweedie writes, "The baboo in charge is a most interesting and highly educated man, and a very keen naturalist. He has travelled he told me to nearly every Zoo in Europe to pick up hints, and the result is that he is gradually making the zoo there as perfect as it is possible to be."

On his return to the country Sanyal was honoured with the title of "Rai Bahadur". In April 1899 R.B. Sanyal was elected Associate Member of the Asiatic Society of Bengal. The year 1899 also brought sorrow to him as his only son expired in mid 1899 and within a year Sanyal's wife also died.

In 1902, Sanyal was appointed member of the managing committee of the Zoo.

Sanyal's Annual Report as the Superintendent of the Calcutta Zoo reflected his medical training, always containing information regarding the causes of death of animals lost from time to time. Even his Handbook contained seventeen post mortem details.

The last work of Sanyal is the *Plea for an Aquarium in Bengal* which appeared in the *Journal and Proceedings of the Asiatic Society of Bengal* June 1908 where he urged for the establishment of a marine zoological station on the coasts of Bengal. He writes, "Artificial fecundation by mixing eggs and milt together is practically unknown in India. An Aquarium will offer to naturalists splendid opportunities for carrying out researches on this line."

Sanyal's work clearly indicates that Sanyal was well read and kept abreast with the latest happenings in the field of zoology.

Ram Brahma Sanyal breathed his last in October 1908. He continued living in the hearts of those that he touched. Sadly, down the years Ram Brahma Sanyal and his work is not well known in his own country. He has become an unsung man of science.

Mr Shakunt Pandey is a freelance journalist. Address:-P 331 Parnasree Pally, Flat No.3A, 3rd Floor, Kolkata-700060; Email: shakuntpan33@gmail.com / shakunt_soumya@rediffmail.com

Genetic Disorders in Humans

PRAMILA MAJUMDAR

- Name this X chromosome linked disease also known as 'Royal Disease' in which blood clotting is affected
 - Haemophilia
 - Leukaemia
 - Erythroblastosis fetalis
 - Purpura
- This syndrome occurs due to a deletion of genetic material on chromosome 5p where a baby's cry resemble that of a cat
 - Patau's syndrome
 - Edward's syndrome
 - Cri-du-chat syndrome
 - Marfan's syndrome
- Colour blindness, a genetic disorder was first reported in 1794 by
 - John Dalton
 - Jerome Lejeune
 - Desire-Magloire Bournville
 - Hooshang Taybi
- Alopecia universalis, is a genetic disorder related to
 - Tooth decay
 - Baldness
 - Memory loss
 - Blindness
- Genetic disorder where cysts are formed in the kidneys is
 - Polycystic kidney disease
 - Menkes disease
 - Cystic fibrosis
 - Angelman syndrome
- Down's syndrome is caused when _____ chromosome has three copies instead of two normal copies
 - Chromosome 13
 - Chromosome 18
 - Chromosome 15
 - Chromosome 21
- Described by H F Klinefelter in 1942, in this syndrome, a male is infertile, shows femaleness in secondary sexual characters
 - Klinefelter syndrome
 - Kline syndrome
 - Infertile Syndrome
 - HF syndrome
- Turner syndrome is when an infertile female is characterized by having only
 - No X chromosome
 - Three X chromosome
 - Four X chromosome
 - One X chromosome
- In this inherited disorder, a liver enzyme called phenylalanine hydroxylase becomes nonfunctional
 - Alkaptonuria
 - Phenylketonuria
 - Galactosemia
 - Hyperoxaluria
- In _____, the shape of the red blood cells is altered to sickle shape.
 - Sickle cell anaemia
 - Haemochromatosis
 - Erythropoietic porphyria
 - Haemochromatosis
- Partial discolouration in the skin, a condition caused when a person's melanocyte is not able to produce melanin, is
 - Albinism
 - Vitiligo
 - Incontinentia pigmenti
 - SADDAN
- In Tay-sachs disease, the nerve cells start to deteriorate gradually due to mutation in the
 - NOTCH3 gene
 - ATPA7A gene
 - HEXA gene
 - NOD2 gene
- In this genetic disorder, premature aging is seen in children leading to death usually by the age of 13.
 - Progeria
 - Prader-Willi Syndrome
 - Prion disease
 - Porphyria
- Xeroderma pigmentosum is where uncovered skin develops tumors when exposed to
 - Chlorine fumes
 - Chlorinated water
 - Nitrogen gas
 - Sunlight
- Cancer of the white blood cell caused by deletion in the long arm of the chromosome 22 is
 - Hemorrhagic telangiectasia
 - Beta thalassemia
 - Chronic myelocytic leukemia
 - Leukodystrophy
- Haemophilia A and B are characterized by lack of blood clotting factor namely
 - III & IX
 - III & IV
 - VIII & IX
 - V & VIII
- Which is the largest protein coding gene present in the X chromosome, whose mutation leads to muscular dystrophy
 - FGFR3 gene
 - IKBKAP gene
 - Dystrophin gene
 - HPRT gene
- 'Protanopia' and 'Deuteranopia' are sex linked inheritance where colour vision is affected and a person is not able to see
 - Brown and blue colours
 - Green and blue colours
 - Red and blue colours
 - Red and green colours
- This genetic disorder related to chromosome 17 causes progressive degeneration of brain's nerve cells in infants
 - Neurofibromatosis
 - Canavan disease
 - Alzheimer's disease
 - Dementia
- Achondroplasia, which is an autosomal dominant disorder, leads to
 - Dwarfism
 - Deafness
 - Cleft lip and palate
 - Cloverleaf Skull

ANSWERS

1.A, 2.C, 3.A, 4.B, 5.A, 6.D, 7.A, 8.D, 9.B, 10.A, 11.B, 12.C, 13.A, 14.D, 15.C, 16.C, 17.C, 18.D, 19.B, 20.A

Contributed by Ms Pramila Majumdar, Jr Scientist, I&BD Division, CSIR-NEIST, Jorhat-785006

Elementary Idea of Hormones

BIRESHWAR PAUL

1. **Father of endocrinology is**
a. G.J. Mendel b. Starling
c. Bayliss d. T. Adison
2. **Nomenclature of hormones was done by**
a. Huxley b. Malpighi
c. Murray d. Starling
3. **Hormones were discovered by**
a. Bayliss & Starling b. D.Roberts & D.Robertis
c. Dallela & Verma d. Parker & Haswell
4. **Largest endocrine gland of the body is**
a. Liver b. Thyroid
c. Adrenal d. Pituitary
5. **Gland of the body having both endocrine and exocrine secretion**
a. Testis b. Ovary
c. Pancreas d. Stomach
6. **Testosterone is secreted by cells of testis known as**
a. Leydig cells b. Sertoli cells
c. Interstitial cells d. Parenchyma cells
7. **Which of the following hormones is an example of permissive hormone**
a. Thyroid hormones b. Renin
c. Pancreozymin d. Gastrin
8. **Thyrocalcitonin is secreted from which cells of the thyroid glands**
a. Para-follicular cells b. Follicle cells
c. Parenchyma cells d. Osteocytes
9. **Pituitary gland is situated in the**
a. Fore brain b. Hind brain
c. Diencephalon d. Telencephalon
10. **The secretion of pituitary gland is controlled by**
a. Hypothalamus b. Epithalamus
c. Thalamus d. Thyroid
11. **Insulin is secreted from which cells of the Islets of Langerhans**
a. Alpha cells b. Beta Cells
c. Gamma Cells d. Delta cells
12. **Hyposecretion of ADH is responsible for a disease known as**
a. Diabetes insipidus b. Diabetes mellitus
c. Acromicria d. Acromegaly
13. **Mammotroph cells of pars distalis of anterior pituitary secrete**
a. Prolactin b. Growth hormones'
c. TSH d. FSH
14. **ADH is secreted by the**
a. Pars Nervosa b. Infundibulum
c. Pars Tuberalis d. Pars Intermedia
15. **FSH (Follicle Stimulating Hormones) comes under which category of hormones?**
a. Steroid b. Amine
c. Polypeptide d. Glycoprotein
16. **The synthesis of which hormone depends on the dietary intake of iodine by a person?**
a. Thyroxine b. Prolactin
c. FSH d. LH (Luteinizing hormone)
17. **Graves disease is caused by the hypersecretion of**
a. Thyroxine b. Calcitonin
c. Testosterone d. Progesterone
18. **Hyposecretion of growth hormones in adult causes**
a. Acromicria b. Acromegaly
c. Dwarfism d. Gigantism
19. **Which of the following hormones is popularly known as emergency hormone**
a. Epinephrine b. Glucocorticoid
c. Mineralocorticoids d. Parathormone
20. **Hormone responsible for the constriction of gall bladder**
a. Secretin b. Pancreozymin
c. Leptin d. Melatonin
21. **Hormone inducing the secretion of hydrochloric acid from the parietal cells of stomach is called**
a. Gastrin b. Cholecystokinin
c. Oestrogen d. Renin
22. **Hormone secreted from the placenta responsible for the development of mammary glands**
a. Human placental lactogen b. Oestrogen
c. Progesterone d. Testosterone
23. **Dopamine is secreted from**
a. Hypothalamus b. Anterior Pituitary
c. Posterior Pituitary d. Thyroid
24. **Diabetes mellitus is a disease caused by the hyposecretion of**
a. Insulin b. Glucagon
c. Somatostatin d. ADH (Anti Diuretic hormone)

ANSWERS

1-d, 2-d, 3-a, 4-b, 5-c, 6-a, 7-a, 8-a, 9-c, 10-a, 11-b, 12-a, 13-a, 14-a, 15-d, 16-a, 17-a, 18-b, 19-a, 20-b, 21-a, 22-b, 23-a, 24-a.

Contributed by Dr. Bireshwar Paul, Faculty of Bio-Science, Halder College of Further Education, 13A, James Hickey Sarani, Kolkata-700069; Email: bireshwar1956@gmail.com



Pollination Biology

AMAL KUMAR MONDAL AND SANJUKTA MONDAL

1. All of the following are pollinators except

- a. Bird
- b. Bees
- c. Wind
- d. Butterfly
- e. None of the above



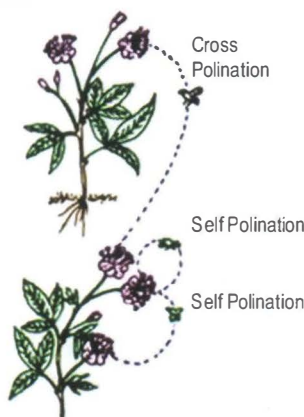
2. Self-pollination involves how many plants?

- a. 1
- b. 2
- c. 3
- d. 4
- e. None of the above



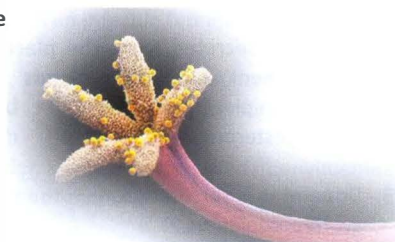
3. How many types of pollination are there?

- a. 1
- b. 2
- c. 3
- d. 4
- e. None of the above



4. The female part of the flower is called:

- a. Stamen
- b. Stigma
- c. Petal
- d. Sepal
- e. None of the above



5. In flowering plants, pollen is released from the

- a. Anther
- b. Stigma
- c. Carpel
- d. Filament
- e. None of the above



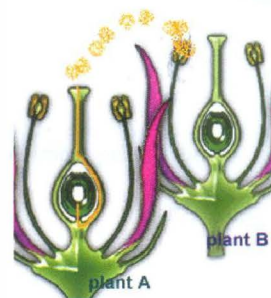
6. Which part of the plant is the sexual reproductive part?

- a. Flower
- b. Fruit
- c. Stem
- d. Leaf
- e. Root



7. Cross-pollination involves the transfer of pollen from

- a. One plant to another
- b. One flower to another of the same plant
- c. One part of the same flower to another
- d. The same flower
- e. None of the above



8. Insect pollinated flower can be described as

- a. Dull flower
- b. Small flower
- c. Brightly colored flower
- d. Dull and small flower
- e. None of the above



9. All of the following floral parts are directly involved in pollination or fertilization except the

- a. Stigma
- b. Anther
- c. Sepal
- d. Carpel
- e. Style



10. What is pollination?

- a. Transfer of pollens from stigma to stamen
- b. Transfer of pollens from stamen to stigma
- c. Transfer of pollens from stigma to ovary
- d. Transfer of pollens from stamen to ovary



11. Hydrophily is pollination by _____ and occurs in aquatic plants which release their pollen directly into the surrounding water.

- a. Earth
- b. Oxygen
- c. Water
- d. Water resources

12. Pollen grains, which contain the male gametes (sperm), are contained within the _____ in gymnosperms.

- a. Flower
- b. Gynoecium
- c. Flowering Plant
- d. Stamen
- e. None of the above



13. _____ are flower traits that attract pollinators, and can be highly specialized.

- a. Anemophily
- b. Bee
- c. Entomophily
- d. Pollination syndrome
- e. None of the above



14. The receptive part of the carpel is called a stigma in the _____ of angiosperms.

- a. Flower
- b. Fruit
- c. Seed
- d. Flowering Plants



15. Pollination through air is called

- a. Hydrophily
- b. Anemophily
- c. Entomophily
- d. Zoophily
- e. None of the above



16. Pollination through water is called

- a. Zoophily
- b. Anemophily
- c. Hydrophily
- d. Entomophily
- e. None of the above



17. Pollination by Bats is called

- a. Zoophily
- b. Ornithophily
- c. Chiropterophily
- d. Entomophily
- e. None of the above



18. Pollination by slugs or snails is called

- a. Zoophily
- b. Ornithophily
- c. Chiropterophily
- d. Malacophily
- e. None of the above



19. Pollination by ants is called

- a. Entomophily
- b. Ornithophily
- c. Chiropterophily
- d. Myrmecophily
- e. None of the above



20. Pollination by insects

- a. Entomophily
- b. Ornithophily
- c. Chiropterophily
- d. Myrmecophily



Answers

- | | | | | | |
|--------|--------|--------|--------|--------|--------|
| 1. e, | 2. a, | 3. b, | 4. b, | 5. a, | 6. a, |
| 7. a, | 8. c, | 9. c, | 10. b, | 11. c, | 12. b, |
| 13. d, | 14. a, | 15. b, | 16. c, | 17. c, | 18. d, |
| 19. d | 20. a | | | | |

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GPS WATCH LETS PARENTS TRACK CHILD'S LOCATION

The GPS watch is the latest GPS tracking device aimed at providing parents with peace of mind. The device pairs with a smart phone or tablet app that shows where a child is at any given moment. It focuses very much on family though, and will also show where other family members are by connecting with the apps on their devices. One particularly useful piece of functionality is the ability for parents to draw a "virtual fence" around specific areas, such as gardens or a school, using the map in the app. A notification will then be sent if the child moves outside one of the predetermined areas.



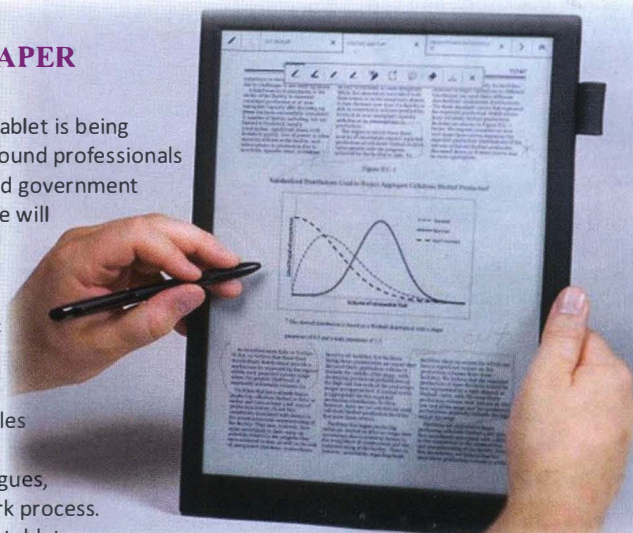
DIGITAL MOTORCYCLE HELMET

The AR-1 is an augmented reality helmet that not only gives you the protection and comfort of a regular helmet, but adds a ton of features never before seen in a motorcycle helmet. The futuristic looking helmet comes with full smart phone integration, offering a number of pretty features. It has visual and audio GPS navigation so you never have to pull over to look at a map. A 180-degree rear-view mirror lets you safely keep an eye on what's happening behind you. The heads-up display is voice activated, so you can control everything from music to text messages with just your voice. The helmet's battery life is around nine hours.

DIGITAL PAPER TABLET

The Digital Paper tablet is being targeted at desk-bound professionals such as lawyers and government officials. The device will be able to convert Microsoft Word, PowerPoint and Excel files into PDF format, and with its USB and Wi-Fi connectivity, the files can be easily shared with colleagues, expediting the work process.

The Wi-Fi-enabled tablet has a 13.3 inch e-Ink Mobius screen, which will allow users to annotate a document whilst resting their hand on the tablet. The tablet hosts 4 GB of internal storage and features a microSD card slot for additional storage. The Digital Paper tablet runs on a rechargeable lithium-ion battery, which will last for three weeks without charging.



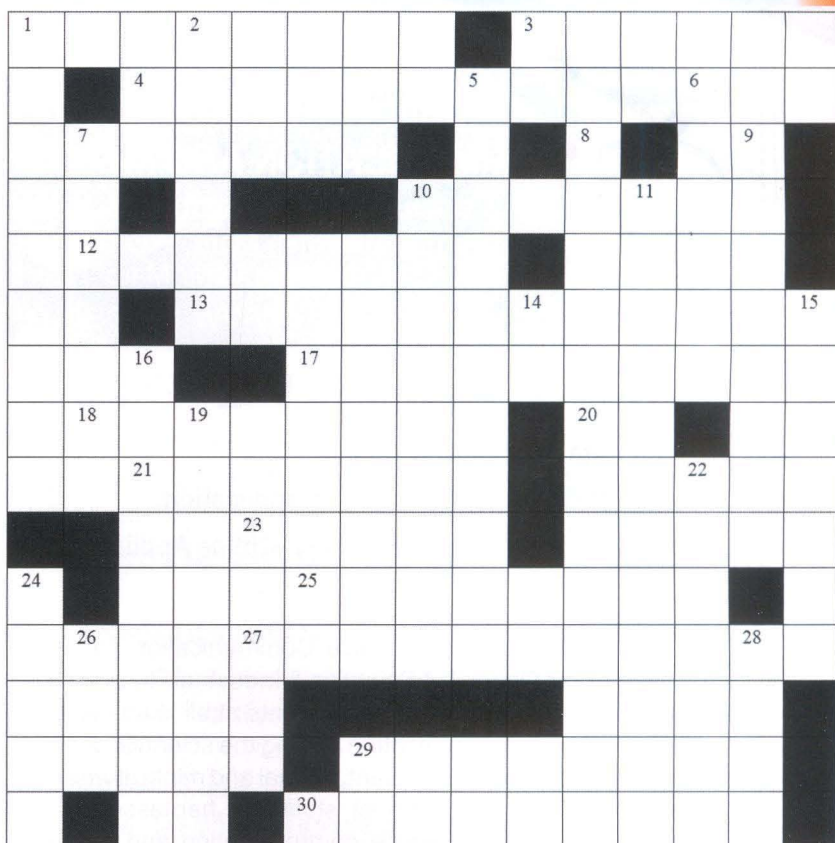
MINUSCULE PACEMAKER

Implantable medical devices have been a huge benefit to millions of people, but there have been problems plaguing this type of technology from the very beginning. A new technology could result in implantable medical devices that are the size of a grain of rice and do not require bulky batteries. The technology has been tested in the form of a pacemaker installed in a rabbit. In this method, a metal plate is placed powered by a cell phone battery. The method uses the rabbit's own body tissue to act to help deliver the electrical signal to the pacemaker.



ACROSS

1. Of, relating to, or having the nature of an alkali (8)
3. Any of various extinct ape-like primates held to be related to present day humans (6)
4. The compound aluminium oxide occurring naturally as corundum (7)
5. An enzyme that converts starch and glycogen into simple sugars (7)
7. Of or relating to high mountains (3)
10. The vertex of a triangle or cone (4)
12. A deficiency in the blood of red cells or their haemoglobin results in pallor and weariness (7)
13. Negatively charged ion (5)
14. A fabric made from the hair of the Angora goat or rabbit (6)
17. Each of the branched horns of a male deer (6)
18. The science of the bodily structure of animals and plants (7)
21. A robot with a human appearance (7)
23. A book of maps or charts (5)
25. The apical portion of a stamen containing pollen (6)
27. A medicine taken or given to counteract poison (8)
29. A place where bees are kept (6)
30. Dry, parched (4)



26. A luminous discharge between two electrodes (3)
28. The upper angle between a leaf and the stem it springs from or between a branch and the trunk (4)

DOWN

1. Each of two or more different physical forms in which an element can exist (9)
2. The first letter of Greek alphabet (5)
5. A small capsule in which a measured quantity of liquid or solid, for injecting, is sealed ready for use (7)
6. A device used to moor a ship to the sea bottom or a balloon to the ground (6)
7. An alloy of mercury with one or more other metals used in dentistry (7)
8. A long threadlike part of a nerve cell conducting impulses from the cell body (4)
9. A lack or loss of appetite for food (8)
11. A unit of length equal to 10⁻¹⁰ metre (8)
15. Coat a metal with a protective oxide layer by electrolysis (7)
16. Pain reliever (9)
17. The main artery of the body supplying oxygenated blood to the circulatory system (5)
19. Any of a group of male sexual hormones (8)
20. A space through which light passes in an optical instrument (8)
22. The loss of sense of smell (7)
23. Airborne Warning and Control System (5)
24. Of, or relating to or received by the ear (5)

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Solution July 2014 Crossword

H	Y	D	R	O	G	E	N		L	Y	M	P	H	B
A	E	R	E				E	S	Y	S	T	O	L	E
E	A	O	D	O	P	A	M	I	N	E		T	A	R
M	S	N	D				A		D		S	A		I
O	T	E	A				T		O	K	I	S	G	B
C	Y	S	T				O		P	U	L	S	I	E
Y			A	X	O	N	D		P	P	V	I	Z	R
A	R	T	E	M	I	A	A		L	F	I	U	Z	I
N	I	A	C	I	N				E	F	C	M	A	
I	S	O	Z	Y	M	E			R	E	U		R	
N	E	W	T	O	N				R	L		D		
	M	I	N	A	M	A	T	A		T	B	O	D	
R	H	O	D	O	P	S	I	N		U				
I			V	A	R	A	N	U	S		R	X	L	A
B	I	O	L	U	M	I	N	E	S	C	E	N	C	E